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MICROSCOPICAL SCIENCE.

—EDITED BY—

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ORIGINAL COMMUNICATIONS.

CLEANING RECENT DIATOMACEOUS MATERIAL.

F. W. WEIR.

IN responding to a request for description of the method employed by myself in cleaning diatoms, I do not claim the merit of novelty for the whole or any part of the process, but simply that, in its essential features, it is the result of experiment, and is more satisfactory than any published method with which I am familiar.

It is a truth well known to students, that no one can obtain from books that which does not already inhere in the student himself. It is equally true, that no method of cleaning diatoms will prove successful in the hands of any operator who does not possess the essential qualities of infinite patience and perseverance in the absence of immediately visible results.

The preparatory cleaning must, of course, vary with the nature of the material. A very poor gathering, requiring a quart or two of material to commence with, and consisting chiefly of coarse sand, should be placed in a large pail of water and stirred with a very rapid rotary motion, allowed to settle a moment, poured off and saved. The pail should be again filled with water, contents rotated, settled and saved. This process should be repeated until nothing but sand remains and until the portion saved is sufficiently concentrated to be suitable for further treatment. If the collection is comparatively rich and consists of the usual marsh deposit—fine sand, partly decayed animal and vegetable matter, and bits of refuse

to which diatoms may adhere—it should be at once subjected to acid treatment, with, however, a thorough washing of salt. In washing great care must be exercised not to lose the diatoms which adhere to floating matter. Very often it is necessary, and always well, to sacrifice a little time and use the filter. For acid treatment I very greatly prefer the sulphuric acid and bi-chromate of potash, cold method. Place the wet material in a porcelain vessel (granite iron cups are serviceable and cheap): add about half as much powdered bi-chromate of potash as there is material; while stirring pour in sulphuric acid slowly, but with increasing rapidity as the intensity of chemical action will allow it, and in most cases, if the proportion of bi-chromate is correct, when the action has ceased, the destruction of destructible matter will be complete. Allow the acid to cool and pour into a gallon jar of filtered water. After thorough settling draw off the liquid with a siphon. Never pour off water at any time during the process. Repeat this until the acid is entirely removed. If the acid cleaning has been complete there will now remain undesirable matter of three kinds—coarse sand, fine sand, and fine amorphous matter—which must be removed in three ways: coarse sand by centripetal force, fine sand by friction, and amorphous matter by gravity.

Place a proportionate quantity of the material in a small tumbler—a liquor glass with slightly convex bottom is good,—between the thumb and finger take a glass rod about ten inches long, suspend with lower end in the glass, and, by giving the hand a rotary motion in a small circle, cause the lower end of the rod to travel round the periphery of the bottom of the glass with the utmost possible speed, giving contents of glass the utmost possible rotary motion. This will, of course, heap up the coarse sand in the center, and the remainder may be drawn off before settling with a siphon applied to the edge of bottom of glass. Refill the glass and repeat the process until nothing but sand remains, which may be thrown away. Take the settlings which have been saved in a larger vessel, return them to the glass, and repeat the rotating process as before. Do this until, with the utmost speed of rotation, no sand can be collected in the center of the glass.

Now place the material in a wide-mouthed vial of suitable size and dispose of the amorphous fine matter. Fill the vial two-thirds full of filtered water and *shake*. Shake as you never shook before. The fine matter adheres to the diatoms and is carried down with them in settling. A quantity of material in this stage that after a

moderate shaking will settle clear in one minute, after a vigorous shaking will not clear in ten: therefore shake. Allow to settle ten minutes, draw off water with siphon and renew. Repeat this until perfectly clear.

Next attack that most terrible bugbear, the fine sand. Take a shallow glass dish with very slightly concave bottom (a photographer's "bender" is most suitable), and place in it a quantity of the material not sufficiently great to heap up much. Now, the friction between water and glass being infinite, it may be conceived that there is a layer of water next to the glass which does not move when the glass is tipped, and the glass must be so manipulated that the fine sand will be retained in this layer, and the diatoms swept over it, and gathered at a point where they may be drawn off with a pipette. Only experience will show how this is best done, but it is possible to effect a perfect separation by rocking and tipping and shaking gently from side to side. As the diatoms are separated from the sand, draw them off with a pipette, add more water and continue until no diatoms are left. Throw away the sand, return the diatoms to the glass and repeat the whole process until the sand is all removed. There may still remain with the diatoms a little of the fine amorphous matter not removed in the ten-minute settlings, and some particles of dust which have entered during the long exposure to the atmosphere. To dispose of these, again place the material in the wide-mouthed vial with filtered water, add a few drops of aqua ammonia, and shake. Now, if it is desired to separate coarse from fine forms, or to eliminate broken frustules, it can be done to a certain extent by microscopic examination of the settlings, and timing them accordingly. In general, allow to settle until all forms desired in a given settling are precipitated, draw off the water into a larger vessel, fill up the vial, shake and settle the same length of time as before, and continue until everything which will not settle in that time is washed out. That material will then be finished. Then take the residue, shake and settle enough longer to deposit the next smaller forms desired. Treat these as before, until all smaller than these are washed out, and so on until nothing is left, which is desirable. Remember that forms which settle, say in one minute, will carry down with them many smaller forms which, after repeated washings of the original one-minute deposit, will be released. It is only by tireless assiduity in shaking and settling that anything like a complete separation can be obtained.

If it is not desired to separate the different forms, but only to remove any fine particles which may remain, simply shake the vial,

and shake it until you are tired; allow the material to settle until the microscope shows that all the diatoms have sunk, siphon off the water and renew it, adding the few drops of ammonia, and repeat until all clear, always replacing the filtered with distilled water in the last three or four shakings.

It has been said that no amount of cleaning can take the place of making a clean collection. Whether this is true or not, and I am inclined to think it is not, the alternative of a poor collection is frequently none at all. By the above method, the most refractory recent gathering can be subdued. A fossil deposit would require very different preliminary treatment, but the method of removing the sand holds equally good.

Concerning apparatus, if it is expected to make the diatoms perfectly clean, the tools must be perfectly clean. The siphon should be thoroughly cleansed before using and before putting away. The pipette should receive particular care. The rubber bulb should be removed. turned inside out and washed, and all vessels used in the latter stages of the process should be chemically celan. Glass stoppers for the shaking bottles should be used instead of cork, and while the diatoms are exposed, all unnecessary bustle should be avoided in the room, as dust is ever present.

As a mounting medium for general use, I have seen nothing superior to styrax properly prepared, and for cement nothing better than hard-oil finish, sold in the paint stores for a dollar and seventy-five cents a gallon. This, with the addition of finest dry lampblack, makes a black cement that is not excelled.

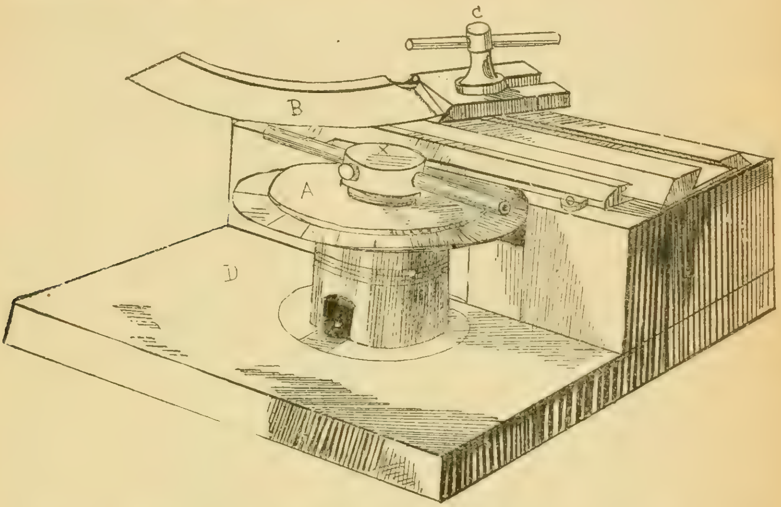
A slide of diatoms cleaned in the manner described, mounted in styrax and ringed with hard-oil finish, followed by hard oil finish with lampblack, will, I am sure, be submitted to criticism with a feeling of perfect confidence.

TAYLOR'S COMBINATION MICROTOME.

THOMAS TAYLOR, M. D.

THIS microtome is adapted to three methods of section-cutting. The instrument is of metal, screwed to a block of polished mahogany. (A) is a revolving table with graduated margin, in the center of which is fitted a freezing box (x), having two projecting tubes, one to admit freezing water and the other as an outlet for it. The water is supplied from the reservoir, and carried off by means of rubber tubing attached to these metal tubes, the terminal end of the

outlet-tubing being furnished with a small glass tube, by which means a too rapid out-flow of water is prevented. The tubes of the freezing-box are so arranged as to prevent their revolving with the revolutions of the table.



When ether is used, the little brass plug in front of the freezing-box is removed, and the rubber tubing detached.

In preparing to make sections, remove the freezing-box altogether, and in its place substitute a cork which projects suitably, and presents the object from which sections are to be taken, embedded in wax or paraffine, at the proper angle to the blade of the knife, regulated by means of the finely cut screw-thread of the table.

(B) Is a curved knife about five inches in length, and about one inch in breadth, ground flat on the under side, and held in position by a binding screw (c) after the fashion of several microtomes now in use. A straight knife may be used if desired.

AGRICULTURAL DEPARTMENT, WASHINGTON, D. C.

VACATION NOTES UPON SOME BOTANICAL LABORATORIES.

CHAS. E. BESSEY.

DR. BARY'S laboratory remains in nearly the condition in which he left it at the time of his death in January. It is housed in a fine stone building standing a few hundred yards back of the main building of the University of Strassburg. Of the build-

ing itself nothing more need be said than that while it is very strong and durable in construction, there can be no doubt that the architect had more to do with directing the expenditure of money than had Dr. Bary. The rooms are not particularly well suited to the work intended to be done in them, and much money was expended for architectural effect alone. The large lecture room is finished much after the manner of such rooms in this country. The lecturer's table is a long one. well provided with accessories, and with ample room underneath for charts and maps. Back of the lecturer are a couple of small preparation rooms, in which material and apparatus are brought together to meet the demands of any particular lecture. Connected with these preparation rooms, by doors, are the rooms containing the botanical cabinet.

The herbarium is stored in a long, narrow room, well filled with rough shelving. The specimens themselves are contained in boxes, and these are slid upon the shelves. A label on the front of the box gives one a clue to the contents.

The laboratories proper occupy several moderate-sized rooms, well lighted. The tables are firm and solid, most of them being fastened along the wall just under the windows. Such tables as are not attached to the wall are simply placed upon the floor, no devices being resorted to in order to reduce the danger of jarring. The tables are of heavy oak construction, but not remarkable otherwise.

The instruments in use in the ordinary student laboratories are all of the usual continental form, *i. e.*, with the simple, low stand, plain stage, sliding-tube and the useful fine adjustment. Mechanical section-cutters are used very little, if at all, the work being done by means of good razors, with the specimen held between the thumb and finger, or imbedded in cork or pith. Facilities for maintaining constant temperatures are supplied, as also for the growing of aquatics, etc.

Taken altogether, one is struck with the extreme simplicity in the outfit. High powers of the microscope are not apparently much resorted to, the objectives usually ranging from our $\frac{3}{4}$ or $\frac{1}{2}$ inch to $\frac{1}{5}$ or $\frac{1}{8}$. Books and periodicals abound, and the student is evidently expected to make good use of them.

Pfeffer's laboratory in Leipzig is in an old building a mile or more from the University. The building has been repaired and altered so as to better fit it for its present uses. One cannot here, any more than at Strassburg, see an ideal arrangement of space for laboratory purposes. Small rooms have been utilized for various purposes, or, where the construction of the building would permit it,

Yours very truly
Wm. J. Lewis

they have been thrown into larger ones by the removal of walls. The small rooms are used for special work, and particularly for advanced students. These rooms have oak tables of solid construction standing near the center, and at these the work is done for the most part. A low table runs just under the window, attached to the wall. There are glass cases against the wall in the back part of the room, and in these various kinds of apparatus and glassware are kept for use. The larger rooms are used by beginners. Here long oak tables of quite rough construction are used. These stand directly upon the floor, and no attempt is made to guard against jarring in any other way than by the weight of the tables themselves.

The microscopes are of the usual continental forms.

At Berlin, Schwendener has rooms in the second story of a building which appears to have been built for some other purpose than of serving for a botanical laboratory. Small and large rooms, with little or no economy of arrangement, are used for offices, private laboratories, laboratories for students, and laboratories for beginners. One of these rooms nearest to the professor's study looks southward, some look westward, some eastward. There is little, if any, north light. The use of large tables in the interior of the room, standing on the ordinary floor, is a marked feature here, as in the preceding laboratories. Side tables against the wall are found in most of the rooms, but the greater part of the work is done at the floor tables. The microscopes are practically like those in Leipzig and Strassburg. Culture apparatus and facilities for maintaining constant temperature are amply provided. Books are at hand, and apparently consulted freely.

UNIVERSITY OF NEBRASKA.

WILLIAM JERAULD LEWIS, A. M., M. D., F. R. M. S., PRESIDENT AMERICAN SOCIETY OF MICROSCOPISTS.

[WITH PORTRAIT.]

F. L. JAMES, M. D.

IN selecting the writer to prepare a biographical sketch to accompany the portrait of the president of the American Society of Microscopists, which is presented in this number of THE MICROSCOPE, the editors of that journal have consulted the personal relations which exist between the subject of the memoirs and the writer

thereof, rather than the fitness of the latter for the task in hand. Feeling this, and knowing the difficulties in the way of preparing a memoir worthy of the subject, it is with considerable diffidence that the work is undertaken. Its meagreness of detail must be ascribed to the author's lack of time and facilities for collating, and not to any deficiency of matters worthy of chronicling concerning the subject of the sketch: since, though a young man as yet, the life of Dr. Lewis has been crowded with incident and adventure, with work and experiences that might well round out the history of one far older in years, as men count them.

He was born March 26, 1856, in the little Connecticut town of Vernon Centre, where his father, Dr. J. B. Lewis, was then living and practising medicine. His parents on both sides were of old Puritan stock, and from them he inherited not only a sound body and a good constitution, but those qualities of mind which are preëminently characteristic of the New England American—an inflexible straightness and directness of purpose, a never-flagging energy, and that keen perception of the motives of men and drift of events usually termed "judgment."

The early education of the boy had scarcely commenced when the political events of 1860-61 culminated in the firing upon Fort Sumpter and the war between the states. Dr. Lewis, his father, was one of the earliest to tender his services to his country, and was appointed a surgeon in the Union army. In order to be near him, the household at Vernon Centre was broken up, the boy removed from school, and the family carried with the doctor to "the front."

Too young to bear a gun, but filled with martial ardor, young Lewis attached himself to a drum corps and for three years served as "drummer boy" in the Army of the Potomac, and saw an amount of active service and actual war that would serve, could it be divided up, to make the stock in trade of a whole regiment of post-bellum veterans and pension hunters.

Being near his father, and at the very front, here too the boy took his first lessons in surgery and daily witnessed a multitude of operations, many of them of the highest grade of military surgery. As he has frequently remarked to the writer, his earliest recollections pertain to this branch of the art and science of medicine.

After the war Dr. Lewis, Sr., returned to New England, and the quandam drummer boy was sent back to school. He entered, later on, the Adams Academy, at Quincy, Mass., and there received a classical education. In 1875 he matriculated in the medical department of Harvard University.

. It was here, in the laboratory of Dr. Thomas Dwight, now Parkman professor of anatomy at Harvard, that the subject of our sketch first made the acquaintance of the microscope, and commenced the practical study of microscopy, devoting much of his time for nine months in the year to human and comparative anatomy. It was at this time that he became acquainted and was brought into daily contact with the lamented Robert Tolles, and from the intimacy thus formed came a friendship which lasted until the death of this incomparable lens maker. Mr. Tolles took a great interest in young Lewis, and embraced every opportunity of giving him instruction in the optics of the microscope and the methods of using lenses to the best advantage.

In 1876 young Lewis left Harvard and entered the College of Physicians and Surgeons, New York, being attracted thither by the superior clinical advantages which it offered. Here his microscopical studies were continued under Professor Delafield. He was graduated from the College of Physicians and Surgeons in 1878, but remained in New York for a year longer, taking special courses in the hospitals of that city.

It was in Albany that Dr. Lewis commenced the private practice of medicine, having the good fortune to effect a partnership with Dr. W. H. Barclay, an old and well-known practitioner, whose daughter he subsequently married, December 10, 1879. In 1879 Dr. Lewis went to Europe, "put in" a couple of years in the laboratories of Vienna and Heidelberg (Berlin had not then become so famous) and returned home in 1881, to finally settle down to fight the battle of life in earnest. He was offered and accepted the position of consulting surgeon to the Travelers' Insurance Co., of Hartford, which office he now occupies.

Already having a "bent" in that direction, the entrance of Dr. Lewis into this position determined him to devote himself to medical jurisprudence, and it is in this direction that his microscopical work has been almost exclusively directed. Having an excellent laboratory, fitted up with the very best instruments that could be purchased, with facilities for experimenting in photography and electrical science, he has devoted a large proportion of his time to the application of electricity to photomicrography and has done some valuable work in that direction.

At Rochester, in 1884, Dr. Lewis read a paper on "Hair, Microscopically Examined and Medico-Legally Considered," and in the working sessions exhibited his microscope and electrical apparatus, to illustrate his method of using electricity in microscopical work.

The duties of his position in the great insurance company with which he is connected require Dr. Lewis to spend a great deal of his time upon the road, traveling all over the continent, thus being brought into personal contact and relations with the scientific men of every part of the country. He is thus frequently consulted in medico-legal investigations other than those that he is constantly prosecuting for the Travelers' Company, and has been retained as expert in many criminal cases involving the use of the microscope.

In 1881 Dr. Lewis was elected an active member of the New York Medico-legal Society; in 1882 he was made a permanent fellow of the Royal Microscopical Society, and in 1883 his Alma Mater conferred on him the honorary degree of Master of Arts. He is also a member of the American Association for the Advancement of Science, and of other national, state and local associations and societies too numerous to mention.

In 1885 he was elected vice-president of the American Society of Microscopists, and in 1888, at Columbus, was made its president.

He is essentially a business man—one who looks after all the details of whatever may be confided to his charge. He is energetic and industrious, and will bring into the affairs of the society the spirit of order and push, and the business methods which characterize the management of his office in Hartford.

PROCEEDINGS OF SOCIETIES.

IRON CITY MICROSCOPICAL SOCIETY.

THE regular meeting of this Society was held December 11th. After the regular routine business, Dr. Edwin T. Painter read a paper on the parasitic fungi found in the human ear; the subject being fully illustrated by slides and charts. An abstract of the paper is as follows:

"It is nearly twenty years since it was demonstrated that plants of a low organization, but veritably and unmistakably plants, occasionally find their way into the channel of the ear, and there cause irritation and inflammation, with attendant serious results. Most of the parasitic fungi that are found in the ear belong to the kind termed Aspergillus, from *aspergillum*, because of its resemblance to the brush with which the holy water is scattered in Roman Catholic ceremonies. Of three varieties, the *Aspergillus niger* is the most common form. In its microscopic appearance, the niger is like

minute particles of coal dust imbedded in a laudaceous mass, which gives the fungus a good setting.

"There is usually an agglomeration of delicate threads, either joined or not, which are somewhat analogous to the roots of higher plants. These threads permeate the tissues attacked by the fungi, forming whitened patches. Aspergillus, when in the ear, has a tendency to seek the deepest parts of the fundus of the canal. It is found on the drum-head, on its outer layer, and in the walls of the inner third of the canal. It may exist in the middle ear, if there be a rupture of the membrane.

"Fungi can be present in the ear without the least perception to one's self. Often, however, there is at first an itching and burning deep in the ear, with a sensation of fullness. To these earlier symptoms are soon added pain, buzzing and hardness of hearing, and at last a watery discharge. The pain is sometimes very great. The buzzing and difficulty of hearing come partly from the pressure against the drum-head, and partly the irritation which the growing parasite brings on. The action of aspergillus is so violent as to sometimes cause perforation of the drum-head. The fungus adheres to the drum-head and to the walls of the canal with such tenacity that often more than one powerful syringing is necessary to dislodge it.

"Warm oil, so frequently placed in the ear, is very favorable to the lodgment and full development of the fungus, particularly when united with the diseased condition for which the oil was thought to be the remedy. It is a strange fact that this aspergillus is far oftener found in the ears of the well-to-do than those of poor people."

Another paper, illustrated by charts and microscopic slides, was read by Dr. D. H. Hengst, on "Tube Casts."

Following the reading of these two valuable communications, the usual exhibit of slides, etc., took place. Mr. Walker shows the wing of the diamond beetle, and a parasite of the house-fly ; Prof. Gordon Ogden, a glass-sponge (Venus' Flower Basket) taken from the bed of the Indian ocean ; Prof. Jackman, scrapings from a stone wall, against which a steam jet is constantly playing, and cyclosis, which showed common rotifers to be present. Mr. W. J. Prentice showed, under polarized light, crystals of guanidine. * Other slides were exhibited by Messrs. Meller and Logan.

A 6-10 power microscope for use in examination of the ear has been devised by Dr. Czapski of Jena.

* A description of this substance will appear in the February issue of this journal.

ELEMENTARY DEPARTMENT.

A COURSE IN ANIMAL HISTOLOGY.

SEVENTH PAPER.

FRANK W. BROWN, M. D.

CARTILAGE.—Three varieties of cartilage can be described:—(1) hyaline, (2) fibrous, and (3) elastic cartilage. The differences in structure found in the three sorts are confined almost entirely to the intercellular substance, the cells being nearly alike in all the forms.

HYALINE CARTILAGE.—With a razor wetted with salt solution, make thin sections from the articulating surface of a fresh long bone. The head of the femur from a frog or young kitten will furnish most delicate specimens. Mount one of the sections in the salt solution and examine with a low power. The cells, large, generally round though of various shape, will be seen scattered about in little groups of three or four through a homogeneous basement or intercellular substance. Near the periphery these cells are arranged somewhat parallel to the surface, whilst deeper down they are more irregularly disposed. Each cell is composed of a delicately granular protoplasm containing a round, well-defined nucleus. At the periphery the cells are sometimes found provided with branched processes showing their development into connective-tissue cells of the synovial membrane. The cell protoplasm in mature cartilage (never in embryonal or infant life) generally contains some fat either in the form of granules or small drops. Although the cell possesses no membrane, it is inclosed by a delicate structureless capsule within a space called a lacuna. In living cartilage the cell entirely fills this lacuna, but after death it shrinks away from the capsule, showing that it was free within the lacuna. Articular cartilage is not covered by any well-marked membrane, but all other cartilages are inclosed by a membrane, the perichondrium.

Make a section from a costal cartilage, stain with carmine and mount in glycerine. This cartilage is of the hyaline variety, the intercellular substance being apparently structureless. The perichondium is seen to be composed of closely-knit bundles of fibrous tissue together with a small number of elastic fibrils. Small blood-vessels are also found in the membrane. These blood-vessels may pass through or into the cartilage, but are not distributed to its substance.

The intercellular substance of hyaline cartilage is apparently structureless, but it is really traversed by numerous delicate fibrils which can be demonstrated by macerating the sections in a 10 per cent. solution of sodium chloride, which dissolves out the cement substance, and then staining in picro-carmine.

Lymph Channels.—The lacunæ communicate with each other through numerous channels, presumably belonging to the lymphatic system. They can be demonstrated by soaking thin sections in ether for an hour and then placing them, while still moist, on a slide and covering them with collodium. Examine with a high power.

Hyaline cartilage is found in the articular and costal cartilages, the thyroid and cricoid cartilages of the larynx, the rings of the trachea, and the cartilages of the bronchi, and the septum and cartilages of the nose. Hyaline cartilage is the cartilage from which the bones are formed.

FIBROUS CARTILAGE.—Make thin sections from an intervertebral disc, stain in picro-carmine, dehydrate and mount in balsam. Examine first with a low and then with a high power. The outer portion of the section is of hyaline cartilage. The fibrous cartilage is distinguished by the bands of white fibrous tissue which traverse the intercellular substance. Treating a section with dilute acetic acid will cause all the fibers to swell, showing that they are of the white fibrous and not elastic variety. The cells usually arranged in rows, resemble those found in hyaline cartilage, although they are not so numerous and are more compressed and flattened. Fibro-cartilage is found in the intervertebral cartilage and generally, though not always, composes the interarticular and sesamind cartilages, the cartilage of the symphisis pubis and margin of the glenoid fossa. Hyaline and fibrous cartilage are intimately related, the former often changing partially or completely into the latter.

ELASTIC CARTILAGE.—Make sections from the external ear or epiglottis, stain with hæmatoxylin, dehydrate and mount in balsam. The elastic fibers found in the intercellular spaces are branched and unite to form a close network. The cells are round and inclosed in large lacunæ, and are scattered irregularly through the tissue. Elastic cartilage is found only in the cartilage of the external ear, of the eustachian tube, of the epiglottis, and the cartilages of Wrisberg and Santorini in the larynx.

CHANGES IN CARTILAGE.—As the individual matures, cartilage undergoes various changes, which are especially marked in old age. These changes are most marked in hyaline cartilage. Make

a section from the costal cartilage of an old individual, stain in hæmatoxylin and mount. The cells will be found somewhat shrunken and granular, the capsule much thickened, and the formerly homogeneous intercellular substance transformed largely into fibrous tissue. This latter change begins quite early, in fact nearly all specimens of costal cartilage will show the beginning of fibrillation of the ground substance. Calcification is a common degeneration of cartilage. It generally begins in the neighborhood of the cells, and extends from them into the intercellular substance. The deposit, composed of the salts of lime, is easily recognized as a granular opaque substance. Cartilage obtained from frogs often shows this deposit.

It may be mentioned here that the so-called tarsal cartilages found in the eyelids are not cartilaginous, but are composed of fibrous tissue.

EDITORIAL.

AN INTERNATIONAL EPISODE.

AT the last meeting of the A. S. M., at Columbus, Prof. A. J. Detmers read a paper detailing the conclusion at which he arrived, after a careful examination and comparison of certain foreign with American objectives. A report of Dr. Detmers' remarks appeared in several journals, and, as a result, there bids fair to be opened up another international controversy, which, however, will consist principally in explanations.

Dr. Roderick Zeiss, son of the famous maker of microscopes, Carl Zeiss and Dr. Van Heurck, well known for his diatom photomicrographs, etc., in the *Journal de Micrographie*, have taken up the cudgels, and if there were cause, there might be waged a mighty war of words. To our question regarding this matter, however, Dr. Detmers replies that the reports of his remarks do him, as well as Dr. Zeiss, great injustice, but that he does not hold himself responsible for any newspaper or journal article that does not bear his signature. "What I did say," writes Dr. Detmers, "has never yet been published, but will appear in the proceedings of the meeting of the American Society of Microscopists, now in print, over my own signature. * * * I have no quarrel with Dr. Roderick Zeiss, nor with any other optician. On the contrary, I highly esteem Dr. Zeiss and the excellent work which he has turned out."

We trust that our friend Prof. Pelletan will voice through his *Journal de Micrographie*, Dr. Detmers' real sentiments as here expressed, and thus bring this matter to an end.

At the same time, however just or unjust criticism may be, every maker of objectives and microscopes must pass through the fire. It is obviously wrong, however, to class all the microscopes made in this country under one denomination, "bad,"—as was recently done,—and place all those made in Germany under the heading "good," for there are good and bad in each. But there is no injustice in comparing the best of one country with the best of another,—and in impartially criticising the weak points and defects in each.

Whatever Dr. Detmers may have said, there are very many competent judges who will almost agree to what he is reported to have said;—not from any desire to discredit the foreign objectives, but simply because the home-made lenses referred to have stood the test of time, and from this point of view remain unequaled.

The President of the American Society of Microscopists informs us that the committee have definitely decided to hold the next meeting of the society at Buffalo. Every effort will be made to make it a successful meeting.

ACKNOWLEDGMENTS.—From J. L. Zabriski, Flatbush, L. I., mounts of vegetable sections; from Dr. J. A. Reeves, Chattanooga, Tenn., histolgical mounts.

TECHNOLOGY.

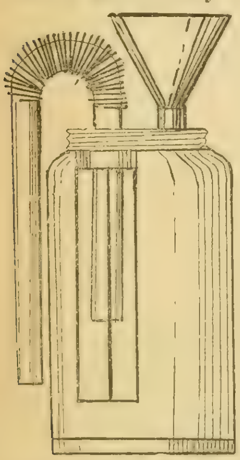
OSMIC ACID AND GOLD CHLORIDE METHODS.

DR. A. K. KOLOSSOW (*Zeitsch. f. wiss. Miki.*) says that the penetrating power of osmic acid, which is intrinsically almost *nil*, may be increased by a mixture of the acid with uranium salt. The author prepares a five per cent. solution of osmic acid in a two to three per cent. solution of nitrate or acetate of uranium (the former is the better). Large pieces of an object, for example, a frog's tongue cut into two or three pieces, are easily penetrated by this mixture, wherein they may remain for sixteen, twenty-four or forty-eight hours without becoming brittle, and only being stained a yellowish-brown color, except the myelin, which is almost black, the medullated fibers and their endings are clearly seen. The author

says that he has had quite satisfactory results with Meissner's and Grandry's corpuscles. The objects fixed by the foregoing solution should be well soaked in water and after hardened in absolute alcohol.

The author also gives the following procedure for treating connective tissue formations with gold chloride. The objects are placed for two, three or more hours in a one per cent. chloride solution, acidulated with hydrochloric acid (100 : 1). After having been washed, they are placed in the dark in a 1-50 to 1-100 per cent. solution of chromic acid for reduction. Though reduction may not at this stage be perfect, it is completed later on in oil of cloves, and the preparation is then mounted in balsam. The more carefully the chromic acid is washed out, the clearer the picture is. The non-medullated nerve-fibers and their ramifications are stained almost black. The connective tissue cells appear just as distinctly, while the intercellular substance of the connective tissue is unstained. Muscle-fibers, striped and unstriped, are stained a greenish-blue color. The author states that this method is almost always certain. —*Royal Mic. Society Journal.*

AN IMPROVED FORM OF WRIGHT'S COLLECTING BOTTLE.*—Dr. H. N. Lyon, of Chicago, having been much annoyed by the clogging of the strainer of Wright's bottle, devised one which obviates this. This is an ordinary metal-top fruit jar, in the cover of which two



holes are made. Into one hole a tunnel for the entrance of water is soldered ; into the other is a tube, about half an inch in diameter. This tube reaches half way to the bottom of the bottle on the inside, and extends far enough above the cover for a piece of rubber tubing to be firmly fastened to it. Surrounding the tube is a square frame, made of four brass rods, reaching almost to the bottom of the bottle. This is covered for $\frac{3}{4}$ of an inch at the upper end by a brass ferrule, soldered to the rods and to the cover. The strainer, which is of fine muslin, is made like a long, narrow bag, and is drawn over the frame and secured by a thread passed around the ferrule. A rubber tube is attached to the outer end of the central brass tube, and a spiral

* Microscopical Bulletin. Oct. 1888.

spring is slipped over it to keep it from bending too short. This tube reaches about an inch below the bottom of the inner tube, and serves as a siphon to draw off the surplus water. It is self-acting, starting when the hole in the funnel reaches the level of the highest part of the bend in the siphon; it continues to act until the level of the water reaches the bottom of the inside tube. If a cork is pressed tightly in the funnel, the bottle can be carried in any position without danger of leaking, while sufficient air will be admitted through the siphon to keep the contents sweet.

NIKIFOROW'S CARMINE.—Dr. Nikiforow (*Zeit. f. Wiss. Mik.*) recommends a formula for a carmine stain which acts intensely on the nucleus, and can be used with advantage for staining specimens in toto, and which does not require after treatment with the strong acids which act harmfully on the tissues. It is prepared as follows: Take 3 parts of carmine, 5 parts of borax and 100 parts of water, and boil in a porcelain dish until a small portion of the carmine has dissolved. Add sufficient ammonia to dissolve the remaining carmine, and the liquid takes on a deep cherry-red color. The mixture is now evaporated by boiling to somewhat more than one-half its volume. Carefully neutralize with dilute acetic acid, when the cherry-red color gives place to one of a carmine tint. The secret is not to get too much acid (Grenacher's carmine), for such a preparation will require after treatment with an acid. The safest way is to add the acid slowly and experiment from time to time. When the solution is prepared, a few drops of carbolic acid may be added, and it will keep indefinitely. Tissues which have been preserved in alcohol are stained by it in about fifteen minutes, though no overstaining takes place after twenty-four hours.

ALCOHOLIC SOLUTION OF HÆMATOXYLIN.—Dr. G. Cucatti (*Central b. f. Bakter. u. parasitenk.*) gives the following formula for making a hæmatoxylin solution which possesses the advantages of never turning bad and of staining only the chromatic part of the nuclei, the color being fixed most deeply in the karyokinetic figures.

Dissolve 25 grm. of pure potassium iodide in 25 ccm. of distilled water and pour the mixture into a glass-stoppered bottle containing 75 ccm. absolute alcohol, shaking the whole repeatedly. Then grind together in a mortar 75 c.grm. of hæmatoxylin crystals and 6 grm. of alum. When these are intimately mixed, add 3 ccm. of the iodide solution. Keeping the mixture well stirred, add little by little the rest of the solution, and then pour into a well-stop-

pered bottle, and leave for ten to fifteen days. At the end of this period, shake up well again and in an hour or two afterwards filter and preserve the filtrate very carefully to prevent evaporation and deposit of iodide crystals. This solution only stains up to a certain point, consequently the sections may be left in it almost indefinitely. —*Jour. of the Royal Micros. Society.*

A NEW HARDENING METHOD.—Carle Bonda describes in the *Centralblatt für die Medicinische Wienenschaften* a new hardening process especially adapted to the central nerve system. It is briefly as follows: The material in mass (as, for instance, the brain of a large dog) is placed for from twenty-four to forty-eight hours in a ten per cent. aqueous solution of pure nitric acid, whence it is removed without rinsing into a solution of potassium bi-chromate, made by dissolving one volume of a cold saturated solution of the salt in two volumes of water. The bi-chromate solution must be replaced in the course of a few hours with a solution consisting of equal volumes of the saturated solution and water. In this the material is left until sufficiently hardened. It is recommended that brain and spinal cord be kept at least eight days in the fluid, and that the temperature be maintained at about that of incubation, or say from 100° to 110° F. The author highly eulogizes the manner in which material thus hardened shows up after staining with hæmatoxylin.—*St. Louis Med. and Surg. Journal.*

A BEAUTIFUL AND DURABLE CEMENT FOR RINGING BALSAM MOUNTS. —Mr. J. D. Beck sends us the following: To a thick solution of gum arabic add a little glycerine to prevent cracking. Ring balsam mounts with this first, then finish with the same cement colored with magenta, or fuchsine, or the "Diamond" black dye dissolved in water. Ornament with gold paint, etc., and finish with "Winsor & Newton's" mastic picture varnish. Try cemnet on a blank slide, if brittle when hard, add a little more glycerine, so that it will harden in twenty-four hours without brittleness.

BACTERIOLOGICAL EXAMINATIONS AT AUTOPSIES.—Babes has presented in the *Archives Roumaines de Médicine et de Chirurgie* an extensive argument in favor of careful bacteriological examinations at *post mortem* examinations. The cadaver should be preserved at a temperature of 5° or 6° C. and washed in $\frac{1}{1000}$ corrosive sublimate solution. The hands of the investigator should be scrupulously clean,

and the sterilization of instruments, etc., should receive careful attention. After the incisions have been made, the various fluids of the body are to be sterilized by plunging a platinum wire into them, and portions then placed in culture tubes or on plates which have been previously prepared. Tissues to be investigated are burned over with a hot glass rod, the part beneath removed, and a piece for examination taken from this by means of a red-hot platinum wire. By inoculation of these various materials thus obtained, Babes is of the opinion that it may be possible to discover, among other things, why the course of infectious diseases in man is so variable in different individuals.

PREPARATIONS FOR HIGH POWERS.*—J. W. Gifford finds, that where a very faithful and instant fixing of the tissue elements is required, a slight modification of Fleming's chrom-acetic-osmic acid is the best agent to employ. On account of the very feeble powers of penetration possessed by this agent, the material must be cut into small pieces before immersing. The fluid employed is made as follows: To a watch-glass of $\frac{1}{4}$ per cent. chromic acid solution, made with distilled water, sufficient osmic acid is added to make it smell distinctly, and finally one drop of formic acid. The fresh material is placed in this from $\frac{1}{2}$ to 2 hours—penetration being hastened by slightly warming the fluid—washed in several changes of water, containing a little glycerine, and stained in a mixture of equal parts of Kleinenberg's hæmatoxylin and glycerine. The staining process should go on for two days, after which the specimen is placed in equal parts of glycerine and water, and kept at a lukewarm temperature for a week or longer, until most of the water is evaporated. It may then be mounted whole, or sectioned and mounted in glycerine jelly, the formula for which is:

Glycerine,	150 grammes.
Isinglass	30 "
Water	q. S.

Dissolve the isinglass in a very little water, clarify with white of egg, strain through muslin, add the glycerine, and keep the whole for some days at about 60° C., until the greater part of the water has evaporated. In this way a very highly refracting jelly may be made.

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* Allen's Jour. of Microscopy. July, 1888.

ABSTRACTS.

CHANGES IN THE ARTERIES OF CONSUMPTIVES.

DR. N. C. IPPA (Vratch. t. IX, No. 20), after reviewing the literature of the subject and stating the methods of his experimentation, arrives at the following conclusions:

1. The arteries have appeared changed by processes entirely similar with chronic fibrous endartritis.

2. Connective tissue has appeared in the intima of such vessels which do not contain it normally, as the axillary, radial, ulnar, femoral, popliteal, anterior tibial, temporal and coronary of the heart.

3. In those arteries, the intima of which normally contain a layer of connnective tissue (as the arch of the aorta, common and internal iliac until the origin of the umbilical artery, but which connective tissue only appears in extra-uterine life—*Prof. R. Thoma, Virchow's Arch. t. XCIII*), there is present in the consumptive a strong development of this layer.

4. The most pronounced changes have been met with in the coronary arteries (playing such a great role) in the intima of which the connective tissue sometimes occupied the whole field of the microscope.

5. The most insignificant changes have been found in the axillary artery, in the arch of the aorta and the femoral.

6. No changes have taken place in the basilar and pulmonary arteries.

7. In the media, atrophy of the muscular fibers has been found with the formation of connective tissue in places corresponding with the alterations of the intima. These two processes go hand in hand.

In conclusion, the writer says: "Whether these changes are the causes predisposing to consumption (as in inherited cases of the disease), or are its consequence, remains, as yet, a question, to decide which requires the investigation, *caeteris paribus*, of arteries: 1st, in persons dead from other diseases than consumption, but also by exhausting processes; and 2nd, in the persons with so-called *habitus phthisicus* (from consumptive families) dead from some other inter current disease before becoming affected with consumption.—*Cleveland Medical Gazette.*

MECHANICS OF ROOT-ABSORPTION.*—De Vries has lately studied the young absorbing roots of plants, with reference to the mechanics of the tissues. He concludes from the following experiments that either the so-called "bundle-sheath" (Kernscheide) or the pericambium, or both, bear the root-pressure. A root of Iris Pseudacorus, 12 cm. long, with the root tips uninjured, was placed under a pressure of 35 cm. of mercury. Every fifteen minutes a microscopically thin tangential section was cut from the root at a place 2 cm. from the tip. No water appeared at the surface of the cut until the sheath was reached, when immediately a drop was exuded. Similar experiments with like results were made upon the roots of Dipsacus Sylvestris, and the stems of various plants. He also shows how the sheath is adapted to resist the filtration of the water under root-pressure before it becomes suberized. De Vries also states that the movement of protoplasm in the cells which take up or transport water is such as to facilitate its passage to the vascular system in the interior. In the root-hairs the rotation is from one end to the other; in the epidermis parenchyma sheath and pericambium the chief stream passes over the tangential and transverse walls. The movement is strongest in the cells in which the absorption of water is greatest. As the suberization of the walls proceeds it gradually decreases, and ceases when the process is complete.

HISTOLOGICAL CHANGES FOLLOWING LIGATURE OF A VESSEL.†—Böttger, following the work of Baumgarten, has investigated the histological changes induced by the ligaturing of a vessel. He proves that a proliferation of the endothelium of the intima takes place by means of karyokinesis, and that the growing endothelium is often separated from the wound, and remains in the still fluid blood-mass. In regard to the condition of the blood in the ligated vessels the author found that he could corroborate the statement of Baumgarten, that in aseptic operations the blood does not coagulate in the vessels. The red corpuscles may be found intact even after four weeks' separation from the circulation. The leucocytes undergo a fatty degeneration by the seventh day or earlier—as the result of which the nucleus is concealed, but is still capable of being stained. The blood placques may remain intact after many days of blood stagnation. Finally, the author notes that in the stagnant blood there is a large number of single nucleated leucocytes in proportion to those having

*Bot. Centralblatt, Bd. xxxv—76-1888. Bot. Gazette, September, 1888.

†Centralblatt, F. Klin. Med. No. 26, 1888.

several nuclei. He holds this condition to be normal, and considers the statement of Einhorn, who examined dry blood preparations, that in normal blood the number of single nucleated leucocytes is much less than the multi-nucleated, to be false.

SPORE-DISSEMINATION OF EQUISETUM.—From a careful examination of *E. avense* and *hyemale*, Newcombe (*Botanical Gazette*, July, 1888) arrives at the following conclusions: (1). The first step in spore-dissemination is the separation of the sporangia-bearing scales by the elongation of the axis of the spike, thus allowing free circulation of air for drying spores and sporangia, and providing open spaces for the escape of the spores after dehiscence of the dry sporangia. (2). The comparatively straight columns or rows of transverse cells in the ventral walls of the sporangium, together with the thinning out of the wall in this region, furnishes a line of weakness which becomes the line of dehiscence. Moreover, the unequal contraction in length and width of the strong external layer of cells of the sporangium-wall results in a greater shortening of the dorsal wall and a slight shortening of the ventral wall, thus causing a wide opening in the ruptured sporangium for the passage of the spores. The hydroscopic properties of the elaters seem to be satisfactorily explained by the difference in chemical composition of the two layers composing them. The function of the elaters is two-fold: (1). To push the spores out of the sporangia. (2). To furnish sails for catching the wind, by which the spores are distributed. Contrary to other observers, Newcombe finds that the sporangium wall contains three or four layers of cells, instead of one, and the reason that these have escaped observation seems to be because of the difficulty in detecting them by looking down upon or through the sporangium-wall. In sections of the sporangium the inner layers of cells become clearly visible.

EARTH WORMS.—N. Kulagin communicates (*Zool. Anzeiger, XI, 231, American Naturalist*) some observations on Russian earth worms which are worthy of note. The cuticle, composed of H., C., O. and N., is not a true chitin, but might be called a precurser of it. It dissolves readily in weak H Cl, and other acids, and to prevent this effect by the humus acids in which the worm lives, the ectodermal glands secrete an alkaline fluid. The egg cocoons differ much, as they withstand strong acids and pepsin. The fluid of the mouth and pharynx has an alkaline reaction, and converts starch into sugar and fibrin into peptone. The calc-glands

also alter starch. The gastric juice is much like pancreatic juice, but is distinguished by the presence of tripsin, and by the fact that it apparently works better in the presence of weak acids. The cells of the typhlosole not only absorb the digestive juices, but they also have a digestive function much like that of the pancreas of the vertebrates. Other observations relate to the histology of the epidermis, the pigment material, the œsophageal glands and the calc-glands. Some notes are made on the distribution of the Russian species, two of which occur even in the Lena Delta.

HUMAN AND ANIMAL BLOOD.—Dr. Cevera asserts that human may be distinguished from animal blood by the following method: If the blood be mixed with a little bile, small crystals are formed which are of different shapes in different species of animals. In man, it is claimed they are right-angled prisms ; in the horse, cubes ; in pigs, right-angled prisms, very similar to those seen in shomboids ; in sheep, shomboidal plates ; in dogs, the same as seen in human blood, and in chickens more or less regular cubes.—*Medical Record.*

Even here there seems to be no help in deciding that most difficult and frequent problem, the differentiation of human from dog blood.

OBSERVATIONS ON PYOGENIC BACTERIA, PARKE.*—All the staphylococcus forms, including the pyogenes albus and aureus and the citreus albus and flavus, grow more rapidly than the streptococcus; they grow better in the absence of oxygen ; they more easily enter the blood-current, and are, by it, more quickly disseminated ; thus, phlegmons, caused by staphylococci, pursue a more acute course, both in time and in intensity of disturbance, and the various cases of septicæmia and pyæmia developed in consequence thereof, seem to be of a more rapid or overwhelming character. In cultures, the staphylococci remain active for a long time ; old cultures of them emit a well-marked odor, much like that of starch paste, as Krantzfeld has noticed, and this odor can be frequently recognized in old dressings which have become saturated with pus. The streptococcus forms grow more slowly, seem to require more oxygen, and manifest a disposition for the lymphatic vessels, rather than for the blood vessels ; it is well known that the streptococcus erysipelatosus is propagated mainly in the lymphatic current.

* *Phil. Med. News*, Dec. 1, 1888.

NEWS AND NOTES.

MR. E. W. D. HOLWAY, in the *Swiss Cross*, replying to one who complained that there was very little use for the microscope during the winter months, said some time spent in collecting through the other seasons would have furnished beautiful objects in abundance.

There is never a time when the microscope need be put aside for lack of material. The yellow dust in the heart of a flower, a drop of stagnant water, the window garden, in fact the whole world, in summer and winter, teems with invisible forms. Let no one feel discouraged and put aside the microscope.

DR. F L. JAMES, in *National Druggist*, says: A beautiful red stain for vegetable sections may be extracted from the parings of wine-sap and other red apples, by absolute alcohol. The paring of a single medium-sized apple gives about 1 drachm of a very deep ruby-colored solution. The writer has experimented but little with the stain, but can say that it is apparently stable. Reasoning from analogy, we should say that light will not bleach it.

EICHORST says that the demonstration of tubercle bacilli is decisive, for they occur in the sputa of no other disease.

DR. VINCENZO TASSINARI, of the Pisa University, has experimented with the effects of tobacco-smoke on bacteria. He finds that delay in development of the germs occur in every instance.

A ZOOLOGICAL laboratory has been opened at Ostend. Four Belgian universities will contribute to its support.

WIDMARK'S experiments with the bacteria of various diseases of the eye, etc., resulted negatively, although fresh material, and that from cultures, were inoculated into the eyes of healthy rabbits. Even in those cases where there was a lesion of the surface, no more than a slight superficial disturbance took place.

THEODORE GILL says that science is a goddess who is rich in attributes, and ready to reward her worshipers, but coy in her gifts. She is generous only to those who worship at her shrine in sincerity and truth, and who supplement their prayers by continual labor and deeds.

THE microscopical anatomy of the common cedar apple (*Gymnosporangium macropus*) has been investigated by Elmer Sanford (Botanical Laboratory, University of Michigan), the results of which appear as a paper in the February *Annals of Botany.*—*American Naturalist.*

MAN, being the servant and interpreter of nature, can do and understand so much, and so much only, as he has observed, in fact or in thought, of the course of nature. Beyond this he neither knows anything nor can do anything.—*Bacon's Novum Organum, Aphorism I.*

BY dissolving Aurantia or Gentian violet in creosote, a staining and cleaning of the section is obtained at the same time.—*Kultschitzky.*

AT the recent meeting of the American Public Health Association, held in Milwaukee, Dr. Theobald Smith of Washington, was down for a paper on "The Relations of Bacteriology to the Discovery and Prevention of Infectious Disease among Men and Animals."

LITTELL (November 17, 1888), reprints from the *London Quarterly Review* an article on "Cruising and Dredging," which will be found of interest to microscopists.

PROF. H. M. WHELPLEY calls attention in *Meyer Bros.' Druggist* to the fact that the ordinary bleaching agents employed in microscopy will corrode the glass of the solid watch-glasses sold for micro-purposes. The action of these agents turns the glass opaque, and renders them unfit for use on the stage of the microscope, where they are often employed, with low power, in the examination of transparent bodies.

SIDNEY J. TINDALL suggests, in *Science Gossip*, the scales from the red currant as a pleasing object under the polaroscope. The scales are obtained by scraping the tongue after eating this fruit.

THE PIN-HOLE CAMERA.—A writer in *Anthony's Bulletin* claims for the pin-hole camera that, by doing without a lens, weight and expense are saved. As wide an angle as the camera will admit of, say 120° on the horizon, may be taken, against 80° to 85° with a wide-angle lens; all objects, near and far, will be in equally good focus; the size of the image may be suited to fit the plate, without changing one's point of view; a view may be taken, if necessary, directly towards the sun, as there is no trouble from fogging caused by the sun illuminating the surface of the lenses.

THE Iowa assembly of the Agassiz Association held its fifth annual convention at Mount Pleasant, August 21 to 23. Dr. F. P. Peck, of the Iowa State Hospital for the Insane, delivered an address on "Notes on the Anatomy of the Brain," and other interesting proceedings occupied the attention of the chapters represented,—14 in all. The next meeting will be held at Oskaloosa.

ANY one who is acquainted with the brilliant work of the physiologists (Heidenhain, Gaskell, Kühne, etc.), must recognize the extreme value of microscopic physiology, and, further, must clearly understand that it means quite as much to physiology as microscopic anatomy does to anatomy.—*Whitman.*

ADULTERATION OF POWDERED SAFFRON.—Rietsch and Cornil (*Jr. de Ph. et de Clin., March 15, 1888*), examined 79 samples of this substance, and found that 49 of them were adulterated. Of these 31 contained florets of *Carthamus*, 4 contained *Santalum rubrum*, 1 was adulterated with *Curcuma domestica*, and 1 was fortified with oil; 5 contained red woods and petals not determined. 7 were double falsifications, of which 4 contained *Carthamus* with *Santalum* or other red woods and a red flower with an admixture of oil. Red woods and amylaceous matters were also found.—*Am. Jr. Pharmacy.*

THE first annual meeting of the Western Society of Naturalists was held at the Illinois State University buildings, Champaign, Ill., Oct. 24th and 25th. Only practical papers, detailing methods and apparatus were allowed to be read.

A PECULIAR rock, known by the name of *chert*, has been found to be made up principally of sponge spicules.

THE *American Journal of Pharmacy* says: The popular notion that ground peppers are extensively and grossly adulterated, while partly true, is mainly a false one.

MITTMAN of Wurzburg, has investigated finger-nail dirt for micro-organisms. In twenty-five cases examined, micrococci were present; then came dipplococci; in eighteen cases bacilli; sarcinæ were found in three,—while moulds abounded.

TO LIQUEFY carbolic acid, fill the space at the neck of the bottle (new) with alcohol and then invert the spirit which will work upward and dissolve the acid; in microscopical work, or indeed in any other kinds, the spirit will do no harm as it will soon evaporate.—*Latham.*

EXAMINATION OF MATTER DEPOSITED FROM THE AIR.—Dr. Whittaker, in *Medical News*, says: So long as microscopy and chemistry constituted the sole means of examining the matter deposited from the air, there could be obtained no precise knowledge, which became possible only with isolation of its particles and cultivation of them in various soils. These investigations, which are necessarily of recent date, have, nevertheless, already disclosed the fact that the air is, as a rule, when compared with the water and the soil, singu-

larly free from pathogenic microörganisms. In fact, the only pathogenic organisms as yet definitely discovered and established by inoculation examinations are the ubiquitous *St phylococcus pyogens aurens* and *streptococcus* of erysipelas.

BOOK REVIEWS.

MICROGRAPHICAL PHYSIOGRAPHY OF THE ROCK-MAKING MINERALS; An aid to the microscopical study of rocks. By H. Rosenbusch. Translated and abridged for use in schools and colleges by Joseph P. Iddings. 121 wood cuts and 26 protomicrographic plates. New York: John Wiley & Sons. 1888: pp. 333.

The old and hackneyed phrase, "fills a long-felt want," is very pertinent in describing this work. Although open to the German-reading scientist for the past fifteen years, Prof. Rosenbusch's manual has, up to the present time, had no English translator, thus bringing it within the reach of the public. That a beginning only has been made in the microscopical investigation of rock is well known; that their preparation and study is as fascinating and absorbing as work in other departments is not yet appreciated. Dr. Idding's book will accomplish much in making the way plain to older microscopists, while beginners will be stirred to explore new fields, which offer so much in the way of discovery. We regret that our limited space will not allow us to give a detailed description of this excellent book, for we consider it one of the greatest importance to the geologist and microscopist. We may say, however, that it is just the guide which we have been looking for, and we strongly recommend it to all those whose inquiries for a reliable work on microscopical petrology have heretofore been answered negatively. The translating has been well done, and the illustrations, especially the photomicrographic plates, will be found of much assistance to the student.

LEE'S OFFICIAL MAP OF THE CITY OF PITTSBURGH, 1888.

This is an excellent colored lithographic bird's-eye view of Pittsburgh, Alleghany, and surrounding towns, showing the location of the various manufacturing interests, and answering the question, "why all roads will lead to Pittsburgh in September?"

LORENZ, WEICHNACHTS UND LAGER BCHER-CATALOGUE.

Our German agent, Mr. Alfred Lorets, has issued his attractive annual catalogue of miscellaneous books for the holidays.

HYSTERIA AND EPILEPSY. By LEONARD CORNING, M. D. Detroit: Geo, S. Davis, 1888.

This latest addition to the Physician's Leisure Library, is, as the author tells us, an amplification of studies which have been already published in two journals. Whatever Dr. Corning writes may safely be said to be authoritative, and the present little volume will not lessen the writer's reputation as a careful and painstaking observer and teacher.

PRICED AND ILLUSTRATED CATALOGUE OF MICROSCOPES AND ACCESSORIES.

James W. Queen & Co., of Philadelphia, have issued their sixty-eighth catalogue, which includes, beside descriptions of their well-known Acme microscopes, a large number of implements and instruments of use to microscopists. An accompanying "Clearance Sale" list offers a desirable lot of instruments and accessories at greatly reduced prices.

CLINICAL LECTURE ON CERTAIN DISEASES OF THE NERVOUS SYSTEM. By J. M. CHARCOT, M. D. Pp. 155, paper 25 cents. Geo. S. Davis, Detroit.

This little work is one of the latest addition to the Physicians' Leisure Library. It has been well translated by Dr. Hurd, and makes delightful as well as instructive reading. Hysteria, especially as observed in the male sex, is the leading subject in the book, and contains much that is new to the general practitioner.

LIST OF MICROSCOPICAL PREPARATIONS. Wood Section. By J. L. ZABRISKI, Flatbush, L. I., N. Y.

A CASE OF TYPHLITIS, with Double Perforation of the Cæcum and Peritonitis. By L. S. MCMURTRY, A. M., M. D. Reprint.

MICHIGAN STATE BOARD OF HEALTH DOCUMENTS.

INFLATION OF THE STOMACH WITH HYDROGEN GAS in the Diagnosis of Wounds and Perforations of this Organ. By N. SENN, M.D., Ph. D. Reprint.

TWO CASES OF GUN-SHOT WOUNDS OF THE ABDOMEN. By N. SENN, M. D., Ph. D. Reprint.

CONSEQUENCES OF ACUTE SUPPURATION OF THE MIDDLE EAR, with Special Reference to Opening the Mastoid. By A. R. Baker, M. D. Cleveland, Ohio. Reprint.

THE PREFERABLE CLIMATE FOR PHTHISIS, ETC. By Charles Dennison, A. M., M. D. Reprint.

ALTRUISM CONSIDERED ECONOMICALLY. Address before the Section of Science and Statistics. A. A. A. S., at the Cleveland Meeting, August, 1888. By Charles W. Smiley, Vice-President Section I. Reprint.

TRANSACTIONS OF THE AMERICAN ASSOCIATION OF OBSTETRICIANS AND GYNECOLOGISTS. Abstract. Reprint.

REPORT OF PENNSYLVANIA STATE BOARD OF HEALTH, 1886. Harrisburg, 1887. Pp. 1056.

This volume of the transactions of the Pennsylvania State

Board of Health, is one of the most elegant in make-up and valuable in contents of the many which have come under our observation. Aside from the valuable reports from the health officers or inspectors in various parts of the State, a number of papers of great importance from the pens of some of Pennsylvania's most distinguished scientists and physicians, are included. A pocket in the back cover contains an excellent map, showing the mortality from diphtheria in the city of Pittsburg, and a table relative to consumption, illustrating a paper by Dr. Wm. Pepper.

CORRESPONDENCE AND QUERIES.

CORRESPONDENTS IN ANSWERING QUERIES WILL PLEASE REFER TO NUMBERS ONLY.

1. (Ans.) W. Y., Belleville, Ohio.—The successors to Hartnack et Prazmooski, are Bézu, Hausser et Cie, No. 1, Rue Bonaparte, Paris, France. There has been no change in the address of this firm.

2. (Ans.) J. H. T., Kansas City, Mo.—We have published several formulas of carmine stain during the past two years, which you will find by referring to the index. The stain which has proved the most satisfactory in our hands is Grenacher's Borax Carmine, which is made as follows :

1 litre 70 per cent. alcohol.
1 " distilled water.
25 grams carmine.
40 " borax.

Cook over a water-bath, and when cool filter. Keep in a well-corked bottle.

3. (Ans.) J. F. O., Morris, Ill.—We cannot furnish you with the journal desired. Our abstract contained all the principal features of the article, with all the cuts.

4. Can you inform me where I can procure a serial set of microscopical specimens illustrating vegetable biology, i. e.: specimens of protophyles, thallogens, acrogens, endogens, exogens?

Petersburgh, Ill. J. D. WHILLEY.

4. (ANS.)—Perhaps Rev. J. A. Zabriski, or some of the dealers whose announcements appear in THE MICROSCOPE may be able to furnish you with the desired specimens.

5. What is the use of the adjustment-collar, and how is it used? I have a Tolles 1-10, Wales 1-15, etc. A. B.

6. What is the best way to remount delicate specimens (mounted five years] in which the glycerine has partly dried up and the cement has mixed in slightly? H. S.

7. Where can I get plants analyzed, to get their proper names? I have some plants sectionized, but cannot identify them in Gray's Botany. One is a vine, has red berries, more like small grapes, but in umbells, the leaves pinnately parted.

J. D. BECK.

7. (ANS.)—Perhaps the editors of the *Bulletin* of the Torrey Botanical Club, Columbia College, New York, or the *Botanical Gazette*, Crawfordsville, Ind.

8. What is the best apparatus by which to get a good background illumination at night? I have seen some apparatus used which gave an excellent bluish daylight effect, but don't know what it was. J. W.

BUREAU OF METEOROLOGY OF THE NORTHWESTERN UNIVERSITY,
CHICAGO, December 31, 1888.

EDITORS OF THE MICROSCOPE:

I have recently had the opportunity of examining several of Zeiss's apochromatic objectives in competition with the recent work of Mr. Herbert R. Spencer, and of the Bausch & Lomb Optical Co. Unfortunately, Messrs. Bausch & Lomb had no homogeneous immersion objective of recent manufacture on hand; but the comparison of the first class $\frac{1}{6}$ with a Zeiss apochromatic of the same power, to my mind, demonstrated that the Bausch & Lomb $\frac{1}{6}$ was quite equal to the Zeiss, if not superior to it.

The comparison of the Zeiss $\frac{1}{12}$ apochromatic, N. A., 130, and of a $\frac{1}{6}$ and $\frac{1}{3}$ apochromatic, with Mr. Spencer's latest work, resulted unfavorably to the Zeiss. In my opinion, the Spencer objectives were decidedly superior to the Zeiss, and this was especially the case in the comparison of the homogeneous immersion objectives of these makers.

I think the durability of the flint glass used by Mr. Zeiss in his apochromatics may fairly be questioned. In three Zeiss apochromatics, which I have recently had the opportunity of examining, the lenses made of this glass showed clear evidence either of deterioration or of having been imperfectly polished when sent out, which latter is highly improbable.

The Zeiss apochromatics have had the effect of stimulating our American makers, to improve upon their already excellent work: and at the present time, there seems to be nothing to be gained in purchasing foreign-made objectives, and especially so at the extravagant prices charged for the apochromatics Quite as good, or better, work can now be had at home for much less money.

Sincerely yours, M. D. EWELL.

TO MEDICAL MICROSCOPISTS.—In behalf of "The American Association for the Study and Cure of Inebriety" the sum of One Hundred Dollars is offered by Dr. L. D. Mason, Vice-President of the Society, for the best original essay on "The Pathological Lesions of Chronic Alcoholism Capable of Microscopic Demonstration."

The essay is to be accompanied by carefully prepared microscopic slides, which are to demonstrate clearly and satisfactorily the pathological conditions which the essay considers.

Conclusions resulting from experiments on animals will be admissible. Accurate drawings or micro-photographs of the slides are desired.

The essay, microscopic slides, drawings or micro-photographs are to be marked with a private motto or legend and sent to the Chairman of the Committee on or before October 1st, 1890.

The object of the essay will be to demonstrate: *First*, Are there pathological lesions due to chronic alcoholism? *Secondly*, Are these lesions peculiar or not to chronic alcoholism?

The microscopic specimens should be accompanied by an authentic alcoholic history, and other complications, as syphilis, should be excluded.

The successful author will be promptly notified of his success, and asked to read and demonstrate his essay personally or by proxy, at a regular or special meeting of the "Medical Microscopical Society" of Brooklyn. The essay will then be published in the ensuing number of "*The Journal of Inebriety*" (T. D. Crothers, Hartford, Conn.) as the prize essay, and then returned to the auther for further publication, or such use as he may desire. The following gentlemen have consented to act as a committee:

Chairman—W. H. BATES, M.D., F.R.M.S., London, Eng.
(President Med. Microscopical Soc., Brooklyn.)
175 REMSEN ST., BROOKLYN, N. Y.

JOHN E. WEEKS, M.D.,
43 WEST 18TH STREET, NEW YORK.

RICHMOND LENNOX, M.D.,
164 MONTAGUE ST., BROOKLYN, N.Y.

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F. L. CAUCH, Dental College, Cincinnati, Ohio.

WANTED—Flesh containing trichina. Will exchange good mounts for same.
J. C. FALK, 800 Morgan St., St. Louis, Mo.

FOR EXCHANGE—A $50 collection of Dr. A. E. Foote's mineral specimens (300), for a good microscope. Address H. A. MUMAW, M. D., Orrville, Ohio.

WANTED—THE MICROSCOPE, Vols. I and II, unbound; Vol. IV, Nos. 2, 3, 4, 5, 8 and 9; also, copies of any works on microscopy not in my library. Address
PROF. H. M. WHELPLEY, St. Louis, Mo.

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FOR EXCHANGE—Good histological or pathological mounts in exchange for other good mounts or material, general or special.
S. G. SHANKS, M. D., 517 Clinton Ave., Albany, N. Y.

WANTED TO EXCHANGE—For anything in the microscopical line: A $60 binocular telescope (field-glass), the Microscopical Dictionary, and other surplus goods. 1,500 objects. E. C. HOYT, 154 Howard St., Detroit, Mich.

MAMMALIAN HAIRS—First-class mounts, to exchange for diatoms and other hairs. Lists exchanged. W. J. MARTIN, Davidson College, N. C.

FOR SALE OR EXCHANGE FOR OTHER BOOKS—A complete set—90 volumes—and odd volumes of Pennsylvania Geological Reports of Second Survey.
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WANTED—The following back numbers: THE MICROSCOPE: Vol. II, No. 1. *The Microscopical Bulletin:* Vol. I, No. 5, August, 1884; Vol. II, No. 1, February, 1885, and No. 5, October, 1885. For any of them I will send a well mounted and interesting slide for each number sent me. M. S. WIARD, New Britain, Conn.

FOR EXCHANGE—A good collection of shells, mostly American species (especially Californian). Wanted—Microscopical books, papers, material, apparatus, etc. Send description of what you have to exchange. Have also collection of duplicates of above shells to exchange for same, or will sell both cheap for cash.
G. R. LUMSDEN.

FOR EXCHANGE OR SALE—Good histological or pathological mounts. Only good slides in any branch of microscopical science desired in exchange. For sale—1 B. & L. Universal Stand, with glass stage, iris diaphragm, neutral tint camera lucida, oculars A and C, last out, with micrometer, double nose-piece, professional objectives, 3-4 and 1-5 inch, Griffith's focus indicator, mahogany case, 1 Griffith club microscope, oculars B and D, student objectives 3-4 and 1-5 inch, in case, all in excellent condition. Also a B. & L. mechanical stage, perfectly new.
WM. N. BEGGS, M. D., 6 N. Beaumont St., St. Louis, Mo.

WANTED—THE MICROSCOPE, Vol. 3, No. 1; Vol. 4, No. 3; Vol. 5, Nos. 4, 5; Vol. 6, Nos. 1, 9; Vol. 7, Nos. 5, 7, 8, 9.
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FOR EXCHANGE—A new and clean copy of Stowell's Manual of Histology—last edition. Wanted—Second-hand copy of Beale's "How to Work with the Microscope." Also, first-class slides of the orange tree insect, to exchange for diatoms in tubes.
E. S. CONTANT, Hawk's Park, Volusia Co., Florida.

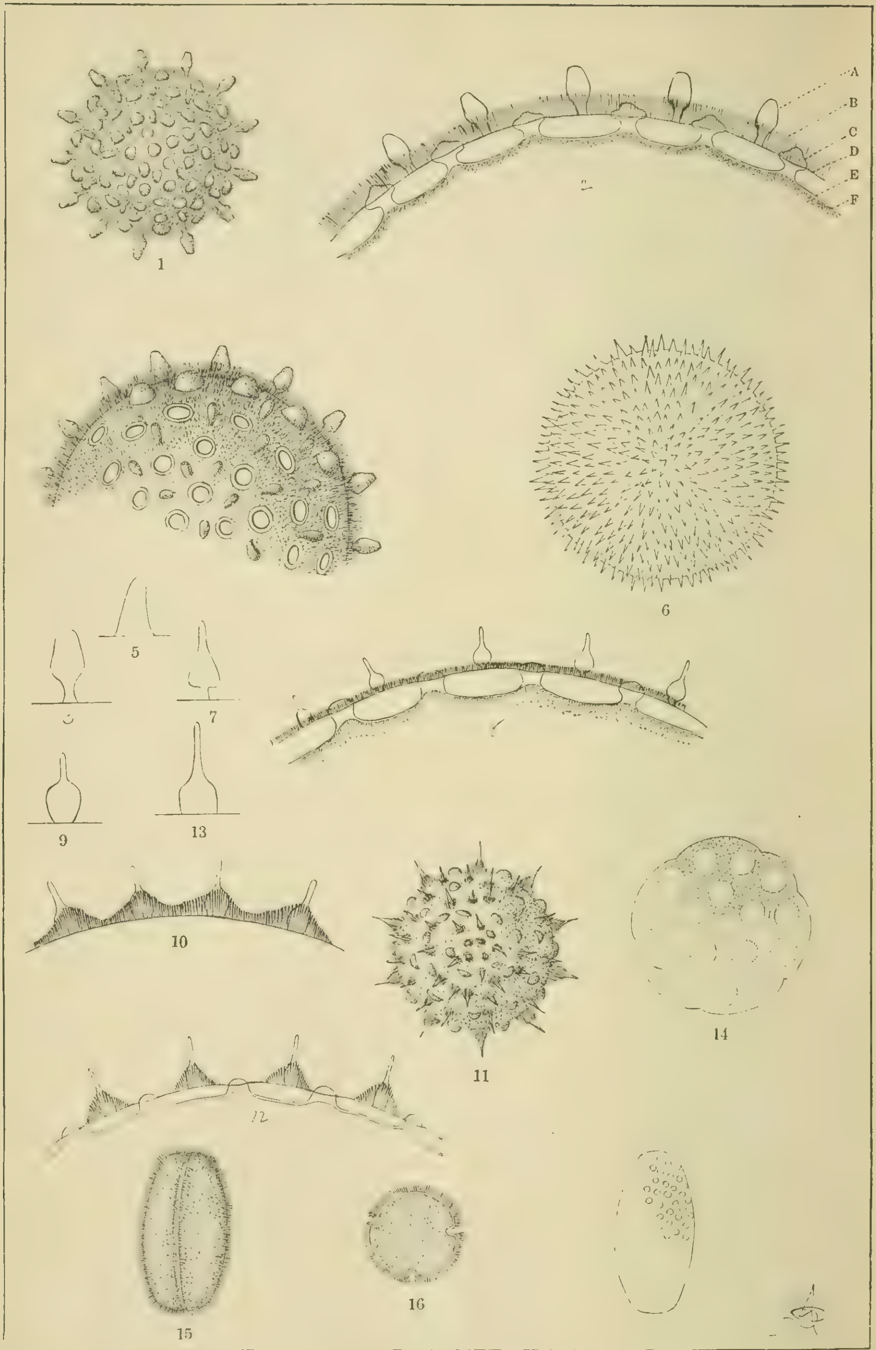

PLATE II.

THE MICROSCOPE.

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VOL. IX. DETROIT, FEBRUARY, 1889. No. 2

ORIGINAL COMMUNICATIONS.

THE POLLEN OF THE MOON-FLOWER (*IPOMŒA BONA-NOX*) AND OF SOME OF ITS ALLIES.

[PLATE II.]

DR. ALFRED C. STOKES.

THE reader may remember to have noticed, early in the spring, an illustrated advertisement in many newspapers and magazines, with laudatory reference to a plant there called the "Moon-flower." The picture represented the front of a two-story cottage smothered beneath a mass of moon-flower vine, the vine itself loaded with a burden of white blossoms whose enormous size seemed ludicrous. The advertisemest announced, in very bad English, that "the vine will grow fifty feet in one season, its moon-like flowers are of the purest white, fifteen inches in circumference. The moon-flower blooms only at night or on dull days ; it gives out a delicious odor similar to the English hawthorn or jessamine."

The ladies of the family planted a moon-flower. They watered it ; they picked the bugs off of it, and the thing grew like Jonah's gourd. I was expecting, indeed rather hoping, to be able to say, "I told you so," when a bud appeared. And such a bud ! It was twice as long as my finger. One evening it began to bloom. I use the word advisedly for, at about seven o'clock that twisted contortion began visibly to unwind itself, and with a gush of perfume, that bud unfolded its great white corolla, deliberately smoothed out the wrinkles, and stood trembling on the end of its peduncle a most

glorious blossom. It is white, the filaments are white, as are the anthers, style and stigma. The whole blossom is like the ghost of a flower, shimmering white in the twilight.

The plant is the *Ipomœa Bona-nox*, L., a native of South Florida and of the West Indies. It seems to have been known for some time as a green-house plant, and to have been extensively cultivated in the South, but it has only recently attracted attention as a desirable bloomer for out-of-doors during the summer and fall, at the North. Its botanical position is among the Convolvulaceæ. It is therefore related to the common "Morning-glory" of the gardens and fields. The five stamens shed so great a profusion of pollen that its abundance attracts attention, and it is to the structure of this pollen, with that of some of its allies, that I here wish to refer.

Externally most pollen is beautiful, some being truly wonderful in its markings and appendages of projecting pores, spines, tubercles, or even lids that rise like circular valves to allow the fertilizing protoplasm to exude. It is the outer surface that the authorities say bears the markings and appendages, the grain being formed of two membranes. The external coat, called the extine, is the last part of the grain to be formed within the anther. It is a secretion from the intine or internal membrane which directly envelopes the viscid, protoplasmic contents, the fertilizing material. The pollen tube which enters the stigma and passes down the style to the ovules, is produced by the growth and protrusion of this delicate internal membrane through the extine, this seeming to be its great function, if we exclude the more or less mechanical duty of enveloping the protoplasm. The extine adds another coat to the grain, thus increasing its firmness, and usually, always and exclusively, according to the authorities, bearing the markings that make pollen so attractive as a microscopic object. Gray says, that "to it all the markings belong;" and Balfour, in the Encyclopædia Britannica (the last edition), that: "The extine is a firm membrane which defines the figure of the pollen grain and gives color to it. It is either smooth, or covered with numerous projections, granules, points, minute hairs, or crested reticulations. The intine is uniform in different kinds of pollen." Other investigators make similar statements, descriptions that are true of most pollen. They are not quite correct, however, in connection with that of the "moon-flower," nor of some other members of the Convolvulaceæ.

The pollen grains of the "moon-flower" are spherical, white, and

about the $\frac{1}{150}$ inch in diameter. The surface exhibits two forms of appendages, one kind being conspicuous at the margin as the grains lie under the lens, the others being easily mistaken for the rounded bases of former. The conspicuous papillæ are irregularly scattered, more or less clavate in form, and entirely hyaline. On the general surface they are less readily seen than overlooked. The others appear as rounded prominences in more regular sequence, and form the most interesting portions of the structure, it being in these that the pollen in question differs from what is usually described by the by the authorities. And in addition to these appendages, the surface is finely villous. The extine is entirely covered with a short pile, like microscopic white velvet, and through this plush-like covering the clavate and rounded papillæ project (see Fig. 1). This velvety surface has never before been observed on any pollen, so far as I know, although it is noticeable on a very common plant.

The constituent filaments of the fringe, or pile, are thickened and variously curved. They seem to be rigid, and adherent to each other, since no manipulation to which I have subjected them has been followed by their separation, or by the pliant motions common to a velvety surface under pressure. They arise directly from the surface of the extine, and measure $\frac{1}{4500}$ inch in length.

The clavate hyaline papillæ take their origin from the same membrane, through a narrow base followed by a constricted pedicle scarcely longer than the surrounding fringe-like appendages, the foot-stalk expanding into a more or less ovate, anteriorly tapering body (Fig. 3). Their perfect, colorless transparency would render any granular or semi-opaque contents plainly visible, but I have seen nothing within them, even under an amplification of two thousand diameters. Their contents must be a thin, strictly homogeneous fluid. Their length averages about $\frac{1}{1800}$ inch. The greatest width is about $\frac{1}{4000}$ inch.

No special preparation, except mounting the fresh grains in balsam for immediate study, is needed to show that their structure differs from that described in the books, for pollen in general. The special points of divergence are obscure under that simple treatment, but enough is divulged to excite interest and urge to further investigation. If the pollen grains are treated with alcohol, the protoplasm will be coagulated, when pressure will rupture the coats and force out the thickened contents, and if a large quantity thus treated is mounted in balsam, some grains will accidentally take the proper position to show the structure. Through the kindness of Dr. W. P.

Manton, the managing editor of THE MICROSCOPE, the pollen was received and sectioned at the Microscope Laboratory. From these sections the writer has been able to study the structure with much satisfaction and profit.

Those papillæ which appear as low and rounded elevations on the extine surface (Fig. 1), arise from the intine and protrude their convex extremities through circular openings in the extine. The two coats are separated by a distinct interval measuring $\frac{1}{4500}$ inch in depth (Fig. 2).

This space is probably filled by a homogeneous fluid, as is presumably the case with the clavate papillæ arising from the extine. I have been unable to see any granules between the membranes, or indeed any contents manifest themselves by optical characters. In sections (Fig. 2) the boundaries of both the extine and the intine are distinctly visible as extremely fine and delicate lines, showing that the membranes have an appreciable thickness, and that they are not in contact, and not connected by a solid intermedium. In Fig. 2 is delineated a part of a section of a pollen grain, showing A the clavate hyaline papillæ, B the villous surface, D the extine, C the short papillæ rising from E the intine, while F represents the enclosed and coagulated protoplasm. The short papillæ originate by a somewhat broad base, followed by a constricted pedicle, terminating in an inflated free extremity which is rounded, yet somewhat tapering to the summit. The height of each papilla is about $\frac{1}{3000}$ inch, including the thickness of the intine. Each, therefore, projects about $\frac{1}{9000}$ inch beyond the external surface of the extine. The diameter at the point of exit through the external coat is about $\frac{1}{3000}$ inch. These measurements, however, are only averages, the distances varying somewhat in different grains.

The pollen of the "moon flower" is an exception, therefore, to the rule that the extine bears all the markings and all the appendages. There are other exceptions in the Convolvulaceæ.

In Fig. 4 is delineated an appearance seen in but one instance. Here the intine seems to have been partially torn away by the manipulation to which the pollen had been subjected, some of the small papillæ having been drawn from and through the extine, leaving what appeared to be circular apertures with thickened margins. But that the reality was what it appeared to be, I am not ready to affirm. The aspect of the object was at least wonderfully suggestive.

IPOMŒA QUAMOCLIT, L. (CYPRESS VINE.)

(*Quamóclit vulgaris*, Choisy.)

The pollen of this species is indistinguishable from that of *Ipomœa coccinea*, except possibly in size, the spherical grains perhaps averaging $\frac{1}{185}$ inch in diameter. The two sizes of extinal, hyaline processes, and the villous covering, are similar to those of *I. coccinea*, and apparently originate in a similar manner.

IPOMŒA COCCINEA, L.

(*Quamoclit coccinea*, Mœnch.)

On this spherical pollen I have been able to observe, with the exception of the short villi clothing the general surface, only hyaline nipple-shaped projections of two lengths, the larger (Fig. 5) measuring $\frac{1}{2250}$ inch in length, by $\frac{1}{4500}$ in greatest breadth, the smaller about one-third that size, or less. They taper gradually from the broad base to the obtusely rounded summit. They appear to originate from the extine. The villous covering is fine and inconspicuous, measuring somewhat less than $\frac{1}{5000}$ inch in length from the origin of the filaments to their free extremities. The pollen is about $\frac{1}{200}$ inch in diameter.

IMPOMŒA PURPUREA, LAM. (COMMON MORNING GLORY.)

It is surprising that the pollen of so common a plant as the morning glory should have been examined by so many observers, and figured so many times, yet always to be incorrectly described and delineated. But such are the facts, unless Edgeworth, in his work on "Pollen," has seen the grain as it is. I have not had access to Edgeworth's book, although I have searched for it in three large libraries in Philadelphia, after having besieged my friends and correspondents, in vain. In the pollen of this well-known flower the surface is villous, but no one has ever noticed it unless Edgeworth has done so. There are two kinds of papillæ, similar to those of the *Ipomœa Bona-nox*, but all observers seem to have seen one set wrong, while no one has ever seen the other. All this is curious, provided that I am correct in my supposition that even Edgeworth has missed these points, an entirely gratuitous assumption on my part; but the strangeness of the oversight is only equaled by the fact that no one has ever had a glimpse of the true structure of the grains, which is very similar to that of the "moon flower" pollen, the extine bearing conspicuous hyaline appendages, and the hair-like growth, while the intine, separated from it by a space $\frac{1}{1500}$ inch in width, gives origin to short papillæ that project through the extine

and the villi. In the fresh pollen temporarily mounted in balsam for immediate study of the surface, the extine exhibits the villi and the hyaline appendages conspicuously, but the shorter rounded papillæ so slightly obtrude themselves on the observer's attention that they seem to have been overlooked, or they may possibly have been mistaken for the bases of the hyaline appendages.

In his "Notes on Pollen," reprinted in the *Monthly Microscopical Journal*, for January, 1877, from the *Gardener's Chronicle*, Worthington G. Smith, F. L. S., refers to the pollen of *Ipomœa purpurea*, giving the delineation here reproduced on a smaller scale in Fig 6.

The extine is represented as studded with acute, conical spines, with no appearance of the villous surface, or of the summits of the smaller, intinal papillæ. The true aspect, as it seems to the writer, is more nearly like that of Fig. 1, the pollen of the "moon-flower." It is spherical, and varies in diameter from $\frac{1}{200}$ to $\frac{1}{150}$ inch. The transparent, colorless apendages, one of which is shown in Fig. 7, arise from the extine by short, narrow, cylindrical pedicles, each of which expands into a more or less obovate body, tapering to the somewhat obtuse apex, and slightly constricted near the center. Their height is about $\frac{1}{2250}$ inch, their greatest width $\frac{1}{6000}$.

The villi of the surface are finer and shorter than those of the *Ipomœa Bona-nox*, measusing $\frac{1}{5000}$ inch in length. There is, however, no difficulty in demonstrating their presence.

The papillæ originating from the intine, as they do in a way similar to those of the "moon flower," are stout, with a somewhat constricted neck, and an evenly convex surface protruded beyond the extine, but scarcely beyond the villi. Their height is about $\frac{1}{3000}$ inch, their free extremities extending about $\frac{1}{9000}$ inch beyond the extine; in Fig. 8, is shown the structure as it appears to the writer.

IPOMŒA BATATAS, LAM. (SWEET POTATO.)

(*Batatas edulis.*)

The pollen grains here differ from those of *I. Bona-nox*, *I. purpurea* and *I. pandurata*, in the form of the extinal processes and the arrangement of the surface villi. The sub-hemispherical papillæ are essentially similar to those of the species already referred to.

The extinal processes are bottle-shaped, the base, or body, tapering slightly toward the basal origin, being subcentrally constricted, with rounded shoulders, and terminating in a narrow,

tapering, obtusely pointed prolongation forming rather less than one-half of the entire hyaline process. The length is about $\frac{1}{2250}$ inch; width $\frac{1}{6750}$. (Fig. 9.)

The villi clothing the general surface are longest immediately around the hyaline extinal processes, thence becoming shorter as they recede from the bottle-shaped projections, only to gradually elongate as they approach the next process. (Fig. 10.) Their length varies about $\frac{1}{9000}$ to $\frac{1}{4500}$ inch. The entire surface of the spherical grain is villous, with the exception of the hyaline projections and the sub-hemispherical papillæ, which are never hirsute in any of these particular pollens. The diameter is about $\frac{1}{235}$ inch.

The sweet potato belongs to the Convolvulaceæ, but the sweet potato seems to be a rare bloomer; or may it be that the cultivators are unobservant? Do the farmers never see the flowers? At any rate I have had trouble to get a specimen. The country within a radius of ten miles from the city where I live, is scored with my bicycle tracks, few of them leading anywhere except to sweet potato patches. In the search, I have had some of the most laughable experiences; indeed, it must have been rather surprising to the unobserving truckman to see a fellow in a Jersey shirt and the shortest of short knickerbockers, come into a potato patch with a bicycle and gravely ask for sweet potato blossoms! The majority laughed in my face; some became quite excited, affirming that sweet potatoes were never known to bloom; others seemed anxious for their personal safety only, getting away as if I were a visitant from another and a nether world. I found but three men and two women who treated the matter seriously, and from one of the women I obtained the sweet potato blossoms. In the search I met an intelligent florist, who has seen the bloom but once in twenty years, although he has cultivated the plant every season; while a man in his employ, although he has lived in a sweet potato region for fifty years, had never seen the plant in flower. Among the many whom I questioned, only the five mentioned above had ever seen what I was seeking.

IPOMŒA PANDURATA, MEYER. (WILD POTATO VINE.)

The pollen of this plant is no exception to that which we have already examined. The spherical grains are rather less than $\frac{1}{200}$ inch in diameter. ($\frac{7}{1500}$.)

The extine gives origin to numerous hyaline processes, with their bases surrounded by villi projecting from the same membrane,

the constituent filaments becoming shorter as they approach the lateral margins of the processes. Each extinal process is thus basally surrounded, while the remainder of the extine is entirely naked, or very minutely villous, the surface of the pollen grain therefore presenting an unusually beautiful aspect. The longest of the villi measure about $\frac{1}{4500}$ inch in length. (Fig. 11).

Small rounded papillæ arise from the intine by broad bases and protrude their evenly convex extremities slightly above the surface of the extine (Fig. 12). Their height is about $\frac{1}{4500}$ inch; their diameter, $\frac{1}{4500}$ to $\frac{1}{3000}$.

The hyaline processes of the extine consist of a cylindrical lower region forming about one-half of the length of the appendage, when it suddenly tapers to the apex (Fig. 13). Their length is $\frac{1}{2250}$ inch; the greatest width about $\frac{1}{6750}$.

IPOMŒA SAGITTATA, CAV.

The structure is here that of the pollen of the sweet potato, so far as the extinal processes are concerned, and of that of *I. pandurata* in connection with the villi of the surface. The former are $\frac{1}{3000}$ inch in length. The rounded papillæ of the intine measure about $\frac{1}{2250}$ inch in diameter, the spherical pollen grains themselves $\frac{1}{200}$, the last mentioned measurement of the grains of the sweet potato being $\frac{1}{235}$ inch, and of *I. pandurata* about $\frac{1}{200}$ inch.

JACQUEMONTIA TAMNIFOLIA, GRISEB.

Here again I can say scarcely more than that the pollen bears so close a resemblance to that of the Ipomœæ examined, that it is hardly distinguishable. The general surface of the extine is finely hispidulous, the velvety growth measuring about $\frac{1}{13500}$ inch in length. The longer hyaline processes are simply conical in form, rising from a base about $\frac{1}{6750}$ inch in width, and tapering evenly to the obtuse apex, the length being about $\frac{1}{3000}$ inch.

The smallest papilliform growths from the intine are conspicuous on the surface, as the superficies of the grain is examined, but their diameter at their exit through the extine is only $\frac{1}{6750}$ inch, their height measuring $\frac{1}{4500}$ inch. The pollen grains themselves are spherical, measuring about $\frac{1}{250}$ inch in diameter.

For the pleasure of examining the pollen of *Jacquemontia*, as well as that of *Ipomœa sagittata*, I am indebted to a generous correspondent in Mobile, Ala., Mr. W. S. McNeill, the well known student of the Diatomaceæ.

CONVOLVULUS SOLDANELLA, L.

(*Calystegia Soldenella, R. Br.*)

Worthington G. Smith, F. L. S., delineates the pollen of this species as shown in Fig. 14. I have not seen it.

CONVOLVULUS SPITHAMÆUS, L.

(*Calystegia Spithamœa, Persh.*)

Here the grains are again subspherical, about $\frac{1}{321}$ inch in diameter, and the entire surface is clothed with a minute hispid growth $\frac{1}{6750}$ inch in length.

CONVOLVULUS SEPIUM, L.

(*Calystegia Sepium, R. Br.*)

Again the grains are simply spherical, about $\frac{1}{281}$ inch in diameter; the surface, however, is entirely clothed with minute villi measuring $\frac{1}{6750}$ inch in length. There appear to be no markings or sulci, and no appendages of any kind, except the fine hirsute growth from the extine. The pollen may perhaps be distinguished from that of *Colvolvulus spithamæus* by the rather larger size of the grains. Otherwise the two seem indistinguishable.

CONVOLVULUS ARVENSIS, L. (BINDWEED).

With the preceding members of the genus the pollen is spherical; with *Convolvulus arvensis* the grains are sub-elliptical, less than twice as long as broad, the surface being longitudinally traversed by three equidistant depressions or sulci, and the entire extine densely clothed with short stiff villi whose free extremities are somewhat thickened. I have not been able to trace these villous appendages through the extine.

The grains vary in size. The average seems to be, in length, about $\frac{1}{300}$ inch; the greatest (central) width $\frac{1}{500}$, the villi being about $\frac{1}{9000}$ inch long. Figure 15 represents the grain, a single sulcus showing; figure 16 a transverse optic diagrammatic section.

In the paper already cited from the "*Monthly Microscopical Journal*," Mr. Worthington G. Smith represents the pollen of *Conuolvulus arvensis* as is shown by figure 17, which is reproduced from his engraving. The grain is delineated as if covered by rounded papillæ, an appearance which I have failed to observe, while no allusion is made to the three longitudial depressions, nor to the hirsute covering, which are really conspicuous in the pollen examined by the writer.

BREWERIA PICKERINGII, GRAY.

(Bonamia Pickeringii, Gray.)

The pollen grains of this rare plant, rare at least in New Jersey, are sub-spherical, $\frac{1}{500}$ inch in diameter, and entirely and minutely hispidulous, the surface growth measuring only about $\frac{1}{1350}$ inch in depth.

The specimen from which the pollen was taken I owe to the kindness of Mr. Isaac C. Martindale, an accomplished botanist, of Camden, New Jersey.

CUSCUTA GRONOVII, WILLD. (DODDER).

The pollen grains of this very common parasite are oval in outline, measuring $\frac{1}{900}$ inch in length, by $\frac{1}{1125}$ in width, the entire surface being hispidulous.

According to Gray's "Manual" there are eight genera forming the Convolvulaceæ: *Quamoclit, Ipomæa*, *Convolvulus*, *Calystegia*, *Bonamia*, *Evolvulus*, *Dichondra*, and *Cuscuta*. In his "Synoptical Flora of North America," he recognizes eight, but makes some intereating changes. *Quamoclit*, *Batatas*, and *Pharbitis* (the two latter not being in the Manual), are merged in *Ipomæa*: *Calystegia* becomes *Convolvulus*: *Bonamia* becomes *Breweria*: and *Jacquemontia* and *Cressa* are added, while the remaining genera are unchanged. When I began to examine the pollen of the group, after having become so interested in that of the "moon-flower," I hoped to be able to see that of at least one species of each genus forming the order, excepting, of course, the genus *Cressa*, of which the only American variety is found "on or near the sea-shore or in saline soil, California, and from Arizona to S. Texas (Hawaian Islands, S. America, &c.)." Although my correspondents have been kind and generous, *Dichondra* and *Evolvulus* are also missing. If the microscopists in the South and West where the species of these genera grow, will examine their pollen, it may be followed by interesting results; it will at least be a satisfaction. The pollen grains need only to be dried and mounted in Canada balsam. The observer may be sufficiently skillful in the use of the microtome to section the grains, in which case still better results will be obtained.

EXPLANATION OF THE PLATE.

Fig. 1, Pollen of *Ipomœa Bona-nox*.

Fig. 2, " " " " Portion of a transverse section: A, extinal papilla: B, extinal fringe: C, intinal papilla: D, extine: E, intine: F, protoplasm, coagulated and withdrawn from the intinal papillæ.

Fig. 3, Pollen of *Ipomœa Bona-nox.* A clavate papilla.

Fig. 4, " " " " Some of the intinal papillæ withdrawn; probably illusory.

Fig. 5, Pollen of *Ipomœa coccinea;* a single extinal papilla.

Fig. 6, Pollen of *Ipomœa purpurea;* reduced from W. G. Smith.

Fig. 7, " " " " a single extinal papilla.

Fig. 8, " " " " portion of a transverse section.

Fig. 9, Pollen of *Ipomœa Batatas;* a single extinal papilla.

Fig. 10, " " " extinal papillæ, with villi.

Fig. 11, Pollen of *Ipomœa pandurata.*

Fig. 12, " " portion of a transverse section.

Fig. 13, " " a single extinal papilla.

Fig. 14, Pollen of *Convolvulus Soldanella;* after W. G. Smith.

Fig. 15, " *Convolvulus arvensis.*

Fig. 16, " " " a transverse optic section. Diagram.

Fig. 17, Pollen of *Convolvulus arvensis;* after W. G. Smith.

GLASS VERSUS METAL MICROMETERS.

PROF. M. D. EWELL.

I THINK most persons who use stage micrometers in the ordinary way, prefer to have them covered, on account of there being less danger of injury and their always being ready for use. When my experience was less than it is now, I remember attempting to clean a really excellent micrometer by Prof. Rogers, one centimeter long ruled the whole length to $\frac{1}{1000}$ of a millimeter. I found out that it was uncovered *after* I had scoured the lines vigorously. It was *then clean*, but that was its only remaining recommendation.

Professor Rogers has experimented much to avoid the sweating that so often obscures the lines when the cover-glass is secured in place by any kind of cement. The most successful method, I think, has been to rule the scale on a cover-glass and mount it with the lines downward, upon a thick ring perforated so as to allow a free circulation of air. This, again, has its peculiar disadvantages, as I have learned *after* the point of my objective (a $\frac{1}{25}$ Spencer) had gone through the cover. The lesson was more impressive after I had paid Mr. Spencer's bill for re-centering the front lens. Micrometers so mounted are very fragile, unless the cover-glass is too

thick for ordinary use. In a later communication I shall describe a device of my own to prevent the sweating above alluded to.

Another disadvantage of micrometers ruled on glass is the fact that there is always more or less uncertainty as to their staying qualities for some time after they have been ruled. This, so far as I have observed, is peculiar to all lines ruled on glass; for I have observed them not only in scales ruled by myself, but on those by Prof. Rogers and Mr. Fasoldt. I do not say that this is universal; but it happens often enough to make the possessor sad. The makers are not to be blamed for this; for it seems due to an infirmity of the material. The only remedy is to let scales on glass season for an indefinite time, like thermometers, before issuing them.

My own judgment is that the very best scales are ruled upon metal. These can be depended upon. I have never seen one deteriorate by simple lapse of time. But these have their disadvantages. They cannot be used with transmitted light, as can scales ruled on glass. Still this difficulty is not insurmountable. I use up to 400 diameters, the opaque illuminating objectives made by Bausch & Lomb, which give excellent results. With higher powers, up to $\frac{1}{18}$, I have used with satisfaction Prof. Smith's vertical illuminator, with a bull's-eye condenser to concentrate the light. With a very high power, a $\frac{1}{18}$ Zeiss', draw-tube drawn out full length, amplifyer and high eye-piecing, I have never yet on my standard centimeter on speculum metal by Prof. Rogers, been able to see anything but clear sharp edges to the lines, saving now and then a little pit in the metal. Of course I understand that no *practical* use can be made of so high a power. I refer to its use simply to show the character of the lines. Any one who has used a glass micrometer with *very* high powers will agree with me in saying that in this respect they are vastly inferior to those on speculum metal.

In order not to change the tube-length, when measuring miscellaneous objects, such as blood-corpuscules, etc., I had Mr. Bullock make for me an adaptor or nose-piece of the same length as my Smith's Illuminator, also made by him, which I screw on to the front of the tube in place of the illuminator, when I desire to measure transparent objects. This sort of a combination is, in my judgment, the very best that can be used. Metal micrometers have the disadvantage, however, of costing more than scales on glass; for such a scale should be ruled on a carefully prepared surface, which of course adds to the expense.

Now as to covering micrometers, in consideration of the disad-

vantages incident to covered scales, I would recommend the use of a scale uncovered. If desired for use with a homogeneous immersion objective, it can be used with a large temporary cover, which can be held down with a mere dot of mucilage or water, not enough to reach the lines. It should not be rubbed, but may be kept sufficiently clean with a camel's hair pencil. I say *sufficiently* clean, of malice prepense. I now think that no one but an amateur with very little experience, will be annoyed by a little dust on a standard when used with a dry objective. If it becomes too thick, it can be removed with a camel's hair pencil. If used with an immersion objective, of course the top of the temporary cover should be clean. I find a little dust a real convenience, as facilitating the finding and focusing of the lines. A really fastidious person should use "Centimeter A" for a time. Its surface, the last time I saw it, was in places seamed and furrowed like the track of a glacier. But enough of it is perfect for any sort of use, and its lines cannot well be excelled. Its correction for total length is very small, and its second millimeter has practically no error.

Of course a micrometer in its ultimate subdivisions, such as are usually used in determining the value to be assigned to one division of the eye-piece micrometer, should have an error so small as to be practically insensible, or its error should be well determined. I have never yet seen, nor do I ever expect to see, a scale in *every* part absolutely free from error. I undertake to say that such a scale can not be made by any living man. But the absolute and relative errors of a scale can be determined within very narrow limits, and a scale can be made, the errors of whose ultimate subdivisions are *practically* insensible. Such a micrometer is practically perfect. In a future communication, should the subject be thought of sufficient importance and interest, I will describe the process by which any good observer, who is the owner of a filar micrometer, and who knows the correction for total length of his micrometer, and last but not least, who has sufficient patience, can determine the errors of any subdivisions small enough to be brought within the field of his microscope.

CHICAGO, October 20, 1888.

LEBER has found that both an alcoholic and an aqueous extract of the *streptococcus pyogenes aureus* are capable of causing suppuration. He has isolated from these extracts a crystalline substance, *phlogozine*, which is the active agent in pus formation.

A METHOD OF USING WITH EASE OBJECTIVES OF SHORTEST WORKING DISTANCE IN THE CLINICAL STUDY OF BACTERIA.

A. CLIFFORD MERCER, M. D., F. R. M. S.

THE working distance of homogeneous immersion objectives of short focus and great numerical aperture is little. In the clinical study of bacteria, sputa and other more or less fluid material are generally prepared on the under surface of cover-glasses, commonly, when not measured and assorted, so thick as to make examination with the above most suitable objectives impossible.

To avoid this difficulty I dry and stain the material on the slide, drop homogeneous immersion fluid upon the preparation and lower the objective into the drop. Homogeneous fluid replaces the cover-glass with optical propriety.

A twenty-fifth, which has been nearly useless over ordinary cover-glass preparations, is now used with gratifying freedom in manipulation over uncovered, but homogeneously immersed, slide preparations.

INTESTINAL PARASITIC INFUSORIA OF FROGS.

PROF. D. S. KELLICOTT.

EVERY teacher of biology knows that the patient frog is a highly useful animal. It is as widely known, and almost as widely practiced,that to demonstrate the action of cilia, a bit of mucous scraped from the roof of the mouth and covered in a drop of 6 per cent. solution of common salt, is excellent. It may not be so generally known that the frog carries in the small intestine a host of parasitic infusoria which demonstrate this phenomenon very finely, in some regards better than the epithelium referred to above. The interesting form appears to be *Nyctotherius cordiformis*, Stein. It may be found by snipping off a short piece of the small intestine, laying it open and scraping the mucous into water on a slide. The species is relatively large, and in the artificial medium soon loses vitality, moves slowly and the long cilia may be seen in action to advantage. Perhaps the normal salt solution of the laboratory is better than water in which to study them. By the way, this *Nyctotherius* I have called *cordiformis*, since it has the same habitat, agrees in form and other specific details, except that, so far as I can make out with careful manipulation, there is no seta rising from the widened entrance to the pharynx, as represented by Stein's figure. It is true that the

posterior border of the pharynx appears to undulate with the long cilia about the peristome field. I incline strongly to the opinion that our form is the same species, except that it is not "cordiformis." Is the European?

COLUMBUS, OHIO.

ELEMENTARY DEPARTMENT.

A COURSE IN ANIMAL HISTOLOGY.

EIGHTH PAPER.

FRANK W. BROWN, M. D.

BONE.—Because of its extreme hardness, the preparation of microscopical specimens of bone requires much care and patience, and even then the results are often far from satisfactory. Indeed, until recently-suggested methods of infiltration were employed, no specimens were produced which could be said to give even approximately correct studies of this tissue. By the older methods, of which there are two, the soft parts of the bone were completely altered or entirely destroyed; yet, as they require less time in their performance and give a tolerable idea of the relations of the hard and soft parts, they are given here.

(1.) With a fine saw make as thin sections as possible from a small, long bone; one of these is to be rubbed down with emery on a stone until as thin as practicable and then polished on a hone or piece of ground glass. Wash thoroughly in water to remove the debris, and mount dry or in Canada balsam. If mounted in balsam it should be well dried and not cleared in clove oil or turpentine. The dry method is to be preferred, as when mounted in some medium the specimens are apt in time to become too transparent. If the worker have sufficient patience, longitudinal sections should be made after the same manner.

(2.) If the bone is decalcified, sections can be made from it with a razor as from any other soft tissue of the body. To decalcify, saw off a section, one-quarter to one-half an inch thick, from a fresh, long bone. Place it for a few days in a one per cent. solution of chromic acid, and then transfer to a fluid composed as follows:

Hydrochloric acid	5
Alcohol	1,000
Distilled water	200
Chloride of sodium	5

(Friedländer.)

The solution should be changed frequently and specimens remain in it for several weeks, or until the bone has become thoroughly softened through removal of the lime salts with which it is impregnated. The action of the fluid can be hastened by the addition of more acid, but the specimens are much more satisfactory when decalcification has been slowly performed. Sections should be dipped in an aqueous solution of picric acid, then stained with carmine and mounted in glycerin.

As was said in the beginning, both of the above-given methods for preparing bone sections are unsatisfactory. By the first method the soft parts are entirely destroyed, and by the second much altered. Nor do the hard parts remain unchanged. No method will give perfect results; but first infiltrating the bone with Canada balsam or some such substance, which will "set" well and thus hold the parts of the tissue together whilst being prepared, is the only method which will preserve the soft parts in a tolerably unchanged state and prevent any marked alteration in the harder portions.

A good, though rather tedious method for performing this infiltration has been proposed by Dr. Weil, in a late number of the *Zeitsch. f. Wiss. Mik.* (Bd. V., S. 200.), which is as follows:

The bone must be fresh and cut with a fine saw into the thinnest possible sections. These are to be placed for a few hours in a concentrated sublimate solution, in order to fix the soft parts. After washing *thoroughly* in water put them into 30 per cent. alcohol; then, after at least 12 hours, in 50 per cent. alcohol, and then, after a like time, in 75 per cent. alcohol. In order to remove the black, sublimate precipitate, they are placed for another 12 hours in 90 per cent. alcohol, to every 100 cc. of which 1.5 to 2. tincture of iodine has been added. The iodine is removed by placing the sections in absolute alcohol, where they are left for some time until they become whitened.

They should now be stained with borax-carmine, which, with an aqueous solution, will take from 1 to 2 days, with an alcoholic solution, from 2 to 3 days, after which they can be transferred to 70 per cent. alcohol, to which 1 per cent. hydrochloric acid has been added, where those stained in the aqueous solution remain for at least 12 hours, and those which have been treated with the alcoholic stain for 24-36 hours. They are now to be dipped into 90 per cent. alcohol and then placed for an hour in absolute alcohol, and finally transferred to some etherial oil for 12 hours or more.

The oil is now to be removed by washing them in pure xylol,

after which they are placed for 24 hours in a liberal quantity of chloroform.

Now take a quantity of Canada balsam and heat it over a water-bath not higher than 90° F., until the mass when cold will crack like glass when broken. Make a thin solution of this with chloroform and immerse the specimens in it for 24 hours. Now, without removing the specimens, add as much more balsam as the chloroform will dissolve, when they are again put over the water-bath, covered with a sufficient quantity of the thickened solution, until the glass-like mass has been reformed. They can now be thinned down on a stone and polished in the usual way, care being taken to wet them frequently with cold water during the operation, in order to prevent overheating. They are to be mounted in chloroform balsam.

This last method, though somewhat more tedious, will give by far the best results and is recommended to those who have the patience to go through with it.

Examine a cross section with a low power. A number of concentric rings will be seen around an open center. The markings of the rings are spaces between layers or *lamellæ* of bone tissue and the open center represents an Haversian canal. Each group of concentric lamellæ, with the inclosed Haversian canal, is called an Haversian system. Looking more closely, it will be seen that all of the lamellæ do not contribute to the formation of an Haversian system, but that many of them are tucked in between the various systems, whilst others run parallel with the surface of the bone. This has given rise to a classification of lamellæ into (1) concentric lamellæ (those forming a Haversian system); (2) peripheric or interstitial lamellæ (those tucked in between the systems); and (3) intermediate or circumferential lamellæ (those running parallel with the surface of the bone). The lamellæ are composed of fine bundles of fibrous tissue impregnated with lime salts.

Between the lamellæ will be seen a number of dark spots representing spaces called *lacunæ*, and, with a higher power, from these a number of delicate channels radiating in all directions, called *canaliculi*. The canaliculi running from one lacuna anastomose with those from neighboring lacunæ, not only of the same system, but with others as well. Lacunæ near the surface communicate in this manner with the periosteum and those nearest the Haversian canals send prolongations into them. It will thus be seen that bone is very vascular.

With a yet higher power examine the lacunæ more closely. Many of them will be seen to contain a nucleated cell, conforming in shape with the lacunæ and sending delicate processes into the canaliculi.

THE HAVERSIAN CANALS.—Longitudinal sections will show that the course taken by these canals is in the direction of the long axis of the bone and that they anastomose freely with each other and communicate eventually with the central canal. They are lined with a delicate, structureless membrane and contain one or two small blood-capillaries, a nerve filament and a lymphatic vessel. The remaining space, if any, contains a few marrow cells, or occasionally, in the large canals, small quantities of delicate fibrils.

THE MARROW.—Marrow is of two sorts, red and yellow. Red marrow is found in the cancellated bone and the softer, spongy portions of compact bones.

From a fresh bone extract a small portion of marrow, stain in carmine or picro-carmine and examine in glycerin. The yellow marrow will be seen to be composed principally of adipose tissue. Together with this are a number of round, nucleated, lymphoid-like cells, the marrow cells. Like the lymphoid cells, they possess the power of amœboid movement.

Red marrow is much more vascular and contains less fatty tissue. There are also a number of reddish-green, nucleated, amœboid cells of different shapes and sizes, which are supposed to be cells undergoing transition from white to red blood-corpuscles. Lastly, are a number of very large, multi-nucleated giant cells (*myeloplaxes* of Robin) found also in the white marrow.

CANCELLATED BONE.—Though differing in some details from compact bone it contains all the elements which go to make up an Haversian system in the latter form. The chief difference is to be found in the marrow spaces. Aside from their containing a red marrow they are unlike the Haversian and central canals of compact bone, in that they are much larger, more irregular and are not distinctly tubular. If it were possible to inflate a long, compact bone through its central canal, and thus cause the Haversian canals to expand and bulge out irregularly, a picture somewhat resembling a cancellated bone might be produced.

THE PERIOSTEUM.—This fibro-elastic membrane which covers the bone can best be studied in sections made from decalcified bone, although it may be necessary to examine a number of sections to find a clear example. It is composed of three layers: (1)

an outer vascular layer containing a number of blood vessels held together by white, fibrous tissue; (2) a middle layer of white fibers containing large quantities of elastic tissue; (3) a layer of soft, delicate, nucleated cells, the osteoblasts. The periosteum is firmly bound down to the bone by means principally of fibro-elastic septa, which are given off from its middle layer and penetrate far into the bone substance. These septa are called the perforating fibers of Sharpe. They are often accompanied by a blood vessel, and in the deeper portions are calcified like the lamellæ, between which they penetrate. They may be studied in cross sections of bone which have been decalcified.

EDITORIAL.

HOW DO MICRO-ORGANISMS PRODUCE DISEASE?

MICROSCOPICAL science and experimental bacteriology have demonstrated the etiological relation of micro-organisms to certain of the infectious diseases, and it is not improbable that fuller observations and experiments will discover the specific microbe of all.

Having demonstrated this fact, insatiable scientific thought demands an answer to the question, how do these organisms induce disease? Why is it that after the entrance, development and multiplication of, for example, the typhoid bacillus there is produced in the infected individual the clinical picture that the physician recognizes as typhoid fever?

Various theories have been offered to explain the phenomena of the specific diseases. It has been held that (1) the microbes produce disorganization of the blood; (2) that they collect in the vessels and there produce mycotic thrombi or emboli and thus interfere with the functions of, or totally destroy the organs of the body; (3) that they consume the proteids of the body; and (4) that they destroy the blood corpuscles.

These theories have not borne the scrutiny of rigid scientific inquiry, and further investigation has led to the belief that the symptoms of the infectious diseases are caused by the circulation in the blood of chemical poisons generated in the body by the development and multiplication of the specific micro-organism.

Under the influence of bacterial life, complex animal tissues are split up into simpler substances, and the process goes on until the ultimate products of organic decomposition, carbon di-oxide, water

and ammonia are formed. Among the intermediate substances formed during putrefaction is a class of bodies, basic in character, containing nitrogen, and having chemical and physical properties corresponding with those of the vegetable alkaloids. These putrefactive alkaloids have been named *ptomäines.*

Brieger and others in Europe, and Vaughan and Novy in this country, have succeeded in isolating from various decomposing substances, and studying, over forty ptomäines, some poisonous, others non-poisonous.

Most of these are produced in decomposing substances outside the body, and excite poisonous symptoms when taken into the alimentary canal.

The poisonous effects of decomposing meats, milk and ice-cream are due to ptomäine formed during putrefaction.

The ptomäines of the infectious diseases are elaborated in the body by the specific micro-organisms, and each micro-organism has its peculiar ptomäine. Thus, the typhoid bacillus elaborates the ptomäine typho-toxine; the bacillus of tetanus, tetanine; the anthrax bacillus, the ptomäine of anthrax, etc. These ptomäines, when introduced into the circulation of animals, induce the characteristic symptoms of their respective diseases.

This field of research is new, but it promises wonderful results in the study of the ultimate etiology of disease, and may be productive of great advances in therapeutics.

ACKNOWLEDGMENTS.—From M. S. Wiard, New Britain, Ct., slide of sand thrown up by earthquake; from Fr. Dienelt, Mellville, Ill., insect mounts; from F. M. Barnard, Oberlin, Ohio, three histological slides; Mr. C. L. Peticolas, of Richmond, has sent us a number of his beautiful diatom mounts. For clean, satisfactory slides, these are beyond criticism.

ZOOLOGY.*

DEVELOPMENT OF MELOE.†—Josef Nusbaum describes briefly the development of the oil beetle, Meloe. This form is very convenient for embryological studies, as it breeds well in confinement and lays little piles of eggs, all the eggs in a single pile developing synchronously.

*Under this heading will be included all Abstracts relating to the Embryology, Histology, etc., of Vertebrates and Invertebrates.

†Biol. Centralblatt, VIII, p. 449-452.—Am. Naturalist, Nov. 1888.

The segmentation nucleus is central, and the cells resulting from the segmentation migrate slowly to the surface, the protoplasm forming a reticulum in the meshes of which the yolk is embraced. Some of these cells reach the surface to form the blastodern, while others remain behind to form "yolk cells." On the third day the ventral plate and the rudiments of the amnion appear very early, the ventral plate becomes segmented, and paired appendages appear on every segment of the body. The primitive groove appears at the same time as the amnion, and develops from behind forward. It soon closes and forms a tube with a very narrow lumen behind, in front a solid cellular in-pushing. This is regarded as gastrulation, and the portion thus invaginated as ento-mesoderm, or primary entoderm, from the hinder portion of which cells are cut off, which wander in and join the "yolk-cells," but have nothing to do with the formation of the mesentoron. The remainder of the primary entoderm differentiates into two large lateral and a middle solid longitudinal band, and in each segment of the former there appears a cavity. The outer wall of this cavity forms the somatopleure, the inner the splanchnopleure and epithelium of the digestive tract. This inner wall soon separates completely from the outer in the middle line, and there becomes two-layered, thus developing both entoderm and splanchnopleure. These lateral bands of entoderm now unite with the middle one and soon enclose the whole yolk and "the yolk-cells," which latter degenerate and are absorbed.

HOLOTRICHOUS INFUSORIA PARASITIC IN THE ALIMENTARY CANAL OF WHITE ANTS.*—Mr. W. J. Simmons, induced by the discovery of Prof. Leidy, of parasitic infusoria in the American white ant, has investigated the white ants of Calcutta, and presented his results before the microscopical society of that city. The alimentary canal of these ants, he says, teem in its lower portion with parasites. Although moniliform and ciliated and non-ciliated organisms, bacteria, spirilla and nematoid worms were found, the present paper is devoted to the Holotricha This infusorian is a free and rapid swimmer. Owing to its constant changes in form, it varies in length and breadth—the measurements of four average individuals gave the following results:

1.	Length $\frac{1}{125}$"	Breadth $\frac{1}{200}$"
2.	" $\frac{1}{125}$"	" $\frac{3}{100}$"
3.	" $\frac{1}{125}$"	" $\frac{1}{250}$"
4.	" $\frac{11}{1000}$"	" $\frac{1}{250}$"

*The Englishman, Calcutta, November 17, 1888.—Read before Microscopical Society of Calcutta.

The cilia at the anterior extremity are longer than elsewhere, and directed forward, forming a fringe or collar, around what is probably the mouth-parts of the organism. In some cases the cilia at the posterior extremity are slightly elongated, and form a more or less conical tuft, but they do not in respect to length approach the cilia of the collar. The body frequently shows parallel spiral markings which may indicate the position of the cilia, or a ridged surface. In some cases trichocysts were observed, but it is not certain that they are constantly present in the cortical layer of these animalcules. There is a distinct and large nucleus, of circular form, the general location of which is central, though it may be nearer one or other end of the body. No contractile vesicle has yet been detected, a feature this parasite shares in common with the genera *Trichonympha* and *Pyrsonema* of Leidy. The body is generally gorged with food, identical in appearance with the contents of the alimentary canal of the termites in which the parasites occur. They appear, therefore, to live directly on the semi-digested food-contents of the intestines of their host. No one who has once examined the living mass which inhabits the white ant need be surprised at the voracious appetite of that destructive insect! The "mouth-parts" of the organism is a hyaline cap surmounting a narrow tube, probably pharyngeal, which is in most cases located at the anterior extremity. It does not occur in all the parasites: and, moreover, in some instances the cap is replaced by a minute hyaline sphere.

Such of the parasites illustrated in Leidy's paper as have been reproduced in Kent's work have no such mouth-parts as are observable in the animalcules which infested a large proportion of the white ants examined; and there are other differences. Simmons expresses himself provisionally as to these organs being mouth-parts, never having seen food particles pass into the mouth, nor through the pharynegal tube, nor detected them in its immediate neighborhood; indeed, the dimensions of some of the particles have been such as to preclude the possibility of their having passed down the tube, unless it be dilatable. From the identity of the food particles in the parasite with those in the intestinal organs of the termite, we must infer with Leidy that an oral aperture exists. It would be interesting to ascertain how the abundance of ingested food in the animalcules gains admission into its body. The infusorian is often observed spinning rapidly on its longer axis without making, or even apparently attempting to make, progress forwards. Its revolving motion on these occasions has been too rapid to admit of determining whether or not it was feeding. Again, in swimming through the semi-

digested food of the termite, the parasite often assumes a helicoidal form at its anterior extremity, similar to the form observed by Professor Leidy in *Triconympha agilis.* Simmons inclines to the belief that on one or other, or it may even be on both, of these occasions the animalcule is taking in food. In two cases animalcules bearing two tubes terminating in a single cap were observed. Is this a phenomenon connected with reproduction, probably by longitudinal fission? On one occasion a parasite was seen apparently undergoing transverse fission.

Associated with the animalcule is another smaller and rarer infusorian. It entirely lacks the mouth parts to which special attention has been called, though it also is not identifiable with any of the figures in Kent's "Infusoria." Whether or not this form differs specifically from the capped animalcule is not determined. Its shape is less variable. The cilia at its posterior extremity are slightly longer than those distributed over the rest of the body; and though the ciliation at the anterior end is directed forwards, it does not assume the appearance of the ciliary wreath or collar observable in the capped animalcule.

The habitat of these parasites in the intestinal tract of the white ant, is probably restricted to the ileum and the colon, as they have not been observed in either the œsophagus, the proventriculus, or the chylific ventricle.

REGENERATION OF CROSS-STRIPED MUSCLE.*—Leven, after a series of interesting experiments, arrives at the following conclusions: At first can be seen in some part of the muscle a faint dimming of the striæ, a slight differentiation of the contractile substance, and a very great increase in the number of nuclei: then, suddenly, as the sarcolemma sheath vanishes, an extraordinary proliferation of nuclei, and the whole contents of the muscle bundle becomes a mass of muscle cells. Besides muscle cells and their protoplasmic coats there are now visible the so-called ribbon-shaped plates, which behave just as the regenerating muscle bundle behaves, only they have less energy of proliferation, and their stages are consequently slower.

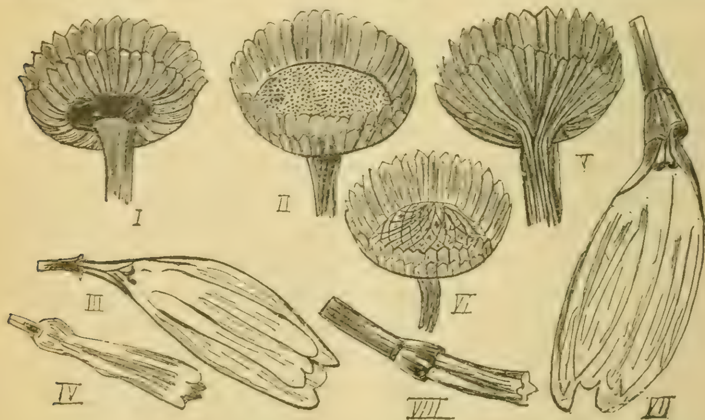
A few steps are still required before the arrival at the fully formed new muscle, and these steps are not as yet quite surely determined. In about ten days multitudes of muscle cells arranged in rows, are found with delicate threads knitting their pointed extremeties, these threads being probably direct and indirect derivatives of a muscle cell, each cell having its own set. The growth of these threads

* Medical Chronicle, Nov., 1888.

and their union cross-junction with others gives the new muscle bundle. Leven admits that he is not quite certain as to this, but he thinks this view more probable than Waldeyer's, who holds that the new bundle is formed from the increase in length and breadth of the muscle cells. In the bundle, presumably formed as described, faint cross striæ are visible toward the end of the fourth week, and about the same time the sarcolemma sheath can be made out. The nuclei, which at first lay in the cell centers, find their way, as the muscle grows, to the periphery. At this time (fourth week-end) there are no karyokinetic figures within the muscle bundle.

BOTANY.*

DALMATIAN INSECT POWDER AND ITS ADULTERANTS.†—Berringer has pointed out that this powder having proved so superior to the Persian Insect powder, the latter has been almost entirely driven out of the market. The large demand for the flowers, from which the powder is made, has resulted in the sophistication of the flower-powder with the ground stems and leaves of the plant. This is the usual condition of the imported powder. Berringer has discovered also, that further adulteration takes place in this country, the Hungarian daisy being imported for this purpose. The close resemblance



HUNGARIAN DAISY.

I. Involucre of dried flower.
II. Receptacle.
III. Ray floret, x. 3.
IV. Disk floret, x. 7.

DALMATIAN INSECT FLOWER.

V. Dried Involucre, x. 2.
VI. Receptacle, x. 2.
VII. Ray floret, x. 3.
VIII. Disk floret, x. 4.

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*Under this heading will be included all Abstracts relating to the various departments of Botany.

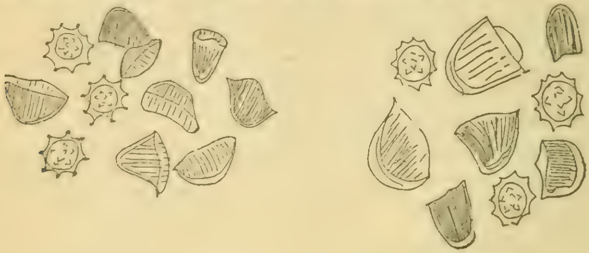
† Am. Jour. Pharmacy, January, 1889, p. 1.

between the Dalmatian insect flower, and the flower of the Hungarian daisy, will be noticed by comparison of the sketches, and the great difficulty in detecting the sophistication appreciated. The Hungarian daisy is thus described: Stems angled, the dried flower-heads averaging about half an inch in diameter, the ray florets being twisted and folded. When soaked in water to their natural size, the flower-heads average $1\frac{1}{4}$ inches in diameter from tip to tip of the ray florets. The involucre broadly campanulate imbricate, the scaly margins chaff-like, the stem being deeply inserted makes it distinctly depressed or concave; greenish-gray in color, glabrous. Receptacle prominent, sub-globular (Figs. I, II and III) convex, dark colored. The ray-florets, numbering about eighteen, are white ligulate, nerved, three-toothed pistillate; the appendages of the style extending beyond the tube. The achenia angled without pappus, but crowned with a faint margin.

The Dalmatian insect flower (*Chrysanthemum cinerariæfolium*, —Bocc.) presents the following characteristics: Stem angled, the whole flower-head ashy gray in color and quite pubescent. Dried flower-heads $\frac{1}{4}$ to $\frac{3}{8}$ inch in diameter, the ray florets being twisted and folded, and frequently broken off. When soaked to the natural size, about $1\frac{1}{4}$ inches in diameter, including the ray florets. The involucre imbricate, the scaly margins membranous, campanulate and convex, without depression at place of attachment of stem. The receptacle small, conical, naked, solid, and light greenish-gray in color. The ray-florets, numbering about eighteen, are white, ligulate, nerved, three-toothed, the tube pubescent, pistillate; the appendages of the style *protruding* beyond the short tube. The achenia angled and nearly as long as the tube, crowned with a membranous (Figs, IV, V, VI), notched (eroded) pappus. The disk-florets numerous, gray, tending toward light yellow in color, tubular, five-toothed, the stamens included. The florets of the true insect powder are somewhat larger than those of the Hungarian daisy. The latter is distinguished from the true Pyrethrum by the orange-yellow disk-florets, by the depression of the involucre, by its prominent dark receptacle, and the absence of pubescence and pappus. The odor is less pungent than that of the true insect flower, being more like that of matricaria. The difference in odor is more pronounced on infusion in warm water. The Hungarian daisy yields a powder somewhat darker in color. Microscopically no difference could be detected between the two powders. Mr. William Kirkby* has written of

* Year Book of Pharmacy, and Trans. Brit. Pharmaceut. Soc., 1888, p. 376.

the microscopical structure of the Dalmatian flower. In the florets of the ray the limb consists of an upper and a lower epidermal layer; the former of these having the cells developed into papillæ, which in the dry state become laterally contracted and readily break away from the base of the cells, and are easily found in the powder; the opposite sides of these papillæ enclose an angle ranging between 55° or 60°, and 90°; the walls are fairly striated the lower epidermal cells being elongated with sinuous walls. The nerves are



1. Pollen grains and epidermal papillæ of Dalmatian insect flower.
2. Pollen grains and epidermal papillæ of Persian insect flower.

composed of narrow spiral trachæ. The florets of the disk consist of elongated parenchyma, most of the cells containing a solitary small klinorhombic crystal of calcium oxalate, or less frequently, a small stellate cluster of crystals. The cells in the papillæ of the stigma are longer than broad, and almost cylindrical. The polen grains which are abundant in the powder, are globular, furnished with spines, and have a diameter from 30μ to 40μ. Sclerotic, elongated, pitted cells, and narrow spiral vessels, form the tissue of the involucral scales, the cells becoming membranous at the margins. The disc consists of irregular parenchyma and fibro-vascular bundles containing many spiral vessels. In the peduncle the parenchyma is made up of large cells, with walls bearing few large pits, which are very sparsely distributed. The Persian Insect powder, which may be substituted for or used to sophisticate the Dalmatian powder, presents almost identical histological characteristics. The papillæ in the former are heavier, larger, and somewhat thicker at the apex, the sides making an angle of from 20° to 50°.

A METHOD of distinguishing between quartz and feldspa in rock sections has been suggested by Becke in the *Mineralogische und Petrographischi Mitthentingen*, X. The former mineral is dissolved by hydrofluric acid, while the feldspa so treated yields an amorphous aluminium fluosilicate, which is capable of staining with an aniline color.

MICROSCOPY.*

A LIMPID COPAL SOLUTION.†—A limpid and colorless solution of gum copal has long been a desideratum to microscopists. The following process is taken by James from the German journal, *Der Techniker*. The latter says that if a high grade of bright copal is chosen, the product will be perfectly limpid and almost colorless. By sorting the copal, a solution as limpid as water may be obtained: Dissolve 4 parts of camphor in 48 parts of sulphuric ether, and add 16 parts of pulverized gum copal thereto. Cork the flask carefully, and stand aside with occasional agitations until the copal is partly dissolved and partly swollen to its fullest extent. Then add 16 parts of alcohol of 96 per cent. and 1 part rectified oil of turpentine, and agitate thoroughly. Let stand with occasional agitations for several days, and at the expiration of a week or so, the contents of the flask will be found to have separated into two layers, of which the lower is rather dark, thick, and possibly dirty, according to the quality of the copal, but above this a layer will be found rich in copal and as clear as crystal itself. The lower layer may be further treated with camphor and sulphuric ether, and afterwards with alcohol, and made to give a still further yield of the crystalline fluid. The only objection to this solution of copal is that it is somewhat brittle when dry. This may be obviated by adding a few drops of purified nut or poppy oil thereto.

MODIFICATION OF WIEGERT'S METHOD FOR STAINING FIBRIN IN SECTIONS.—‡The method, which is described in detail in the *Fortschritte der Medicin*, vol. xviii., p. 693, 1888, is as follows: The sections are spread out on glass slides, dried with filter paper, stained for five minutes in gentian anilin water, and again dried with filter paper. They are then placed in Lugol's solution of iodine for from thirty to sixty seconds, and finally decolorized in a mixture of xylol one part, and anilin oil two parts. They are mounted in balsam. The specimens should be hardened in alcohol. By this method the shreds of fibrin are stained a deep blue, all the other parts being decolorized. They show much better in the daytime than by artificial light.

* Under this heading will be included descriptions of New Instruments, Microscopical manipulations, Stains and Re-agents, Photomicrography, etc.

†St. Louis Medical and Surgical Journal, October, 1888.

‡ Medical Review, November 10, 1888.

PATHOLOGY.*

CANCER AND ITS CASUAL AGENT.†—Opinions differ, even among the most eminent of pathologists, as to the part which the microbe plays in the production of cancer. Sir James Paget considers that it is now practically demonstrated that each specific disease is due to the influence of a distinct morbid substance. This morbid substance is, in the vast majority of cases, a microbe—a low vegetable organism—and Sir James thinks that some day micro-parasites will be found in essential relation with cancer. Virchow, on the other hand (*Lancet*) evidently attaches no importance to the reported discovery of a cancer bacillus; nor does he think that the discovery of a cancer micro-organism is necessary to ex plainthe known facts of the disease. He is strongly in favor of its local origin, and, firm in this belief, he entertains the hope that some means will yet be found of eradicating the disease in its early stage, and urges surgeons not to be too skeptical of the possibility of curing cancer by drugs. Paget also asserts his belief that we may reasonably hope for a remedy against cancer—a specific remedy for a specific disease.

NEWS AND NOTES.

THE *American Naturalist*, Nov., 1888, says that three species of algæ, belonging to two genera, have been recently described as occurring on the hairs of sloths. The green species is placed in the new genus *Tricophilus* in the family Chroolepideæ, and the violet ones in the genus *Cyamoderma*, also new, of the family Chamæsiphoneæ. It has been estimated that as many 150,000 to 200,000 individuals often occur upon a single hair.

CATTANEO records the existence of a parasitic ciliate infusorium (*Anophrys maggi*) in the blood of the crab, and Geza Entz another ciliate in the blood of *Apus cancriformis*.—*Am. Naturalist*.

MR. FRANK S. COLLENS publishes in the *Botanical Gazette*, December, 1888, a list of 108 species of algæ collected at Atlantic City, N. J.

FEWKES has found a copepod crustacean parasitic in the brood cavity of the common Brittle star.

* Under this heading will be included all Abstracts relating to the Histology of Diseased Tissues, both Animal and Vegetable.

†The Canadian Practitioner.

BOOK REVIEWS.

CHEMICAL LECTURE NOTES. Taken from Prof. C. O. Curtman's lectures at the St. Louis College of Pharmacy. By H. M. Whelpley, Ph. G., Professor of microscopy and Quiz master of Pharmacognosy and Botany in the St. Louis College of Pharmacy, etc. Second edition, revised and enlarged by the addition of notes on the metals. St. Louis, Mo. Published by the author, 1888.

In the preparation of this little volume the author has followed the full lectures given by an eminent teacher of chemistry to his class of pharmaceutical students. The object of the author is evidently to give to students a convenient book for the review of lectures and for ready reference in the class room and laboratory, in place of the imperfect notes that they may take for themselves. We believe the attention given to note-taking at lectures distracts the student's mind and prevents him from fully digesting, at the time, the expressions of the teacher. With an aid such as the one before us, the student can concentrate his mind on the substance of the lecture and then review it in his quiet study hours. The notes are very full and cover the whole field of chemical physics and inorganic chemistry. The notes on the salts of the metals will prove to be of very great value to the laboratory student. In the part devoted to theoretical chemistry we notice some deficiencies. Nothing is said of the laws of the combination of elements by weight and volume, and but a few lines are given to the important subject of violence. In a book containing such a mass of facts these are minor deficiencies. When the author shall see fit to add notes on the chemistry of the carbon compounds he will have one of the most complete of handbooks on chemistry.

PROCEEDINGS OF THE AMERICAN SOCIETY OF MICROSCOPISTS. Eleventh Annual Meeting, held at Columbus, Ohio, August 21st to 24th, 1888, Vol. X.

Although somewhat smaller in size than the Proceedings issued for the past two or three years, the volume before us shows a table of contents that is in no wise inferior to those already published. Indeed, although the attendance at the Columbus meeting was comparatively small, the papers were of an unusually high character, and appear in the proceedings without the customary *padding* of productions less meritorious. The typography, paper, illustrations and general mechanical work are excellent, and we congratulate the publication committee on the prompt issuing of the volume.

One defect, however, which we cannot overlook, is the absence of the Treasurer's report, and the statement of the Custodian as to the Society's property in his hands. As these reports might, we should

imagine, have been prepared with very little expenditure of time and trouble, we cannot understand why Treasurer Mosgrove, who is also on the publication committee, should have neglected this very important duty.

THE YEAR BOOK OF PHARMACY, with the Transactions of the British Pharmaceutical Conference held at Bath, September, 1888. London: J. and A. Churchill, 1888, pp. 105.

This really excellent work contains a very large number of abstracts of papers relating to pharmacy, materia medica and chemistry, published between June, 1887, and July, 1888, which are of equal importance to pharmacist and physician. It is a valuable ready reference book, giving the digested opinion of leading investigators in these departments in regard to the actual value of drugs and chemicals which have been added to the list during the past year. The transactions of the Pharmaceutical Society add greatly to the interest and usefulness of the volume.

HATCH EXPERIMENT STATION OF THE MASS. AGRICULTURAL COLLEGE. Bulletin No. 3. Jan., 1889.

In this bulletin Dr. Charles H. Fernald has made a valuable summary of what is known in regard to tuberculosis, particularly in animals.

COMPENDIUM OF THE LAWS RELATING TO PUBLIC HEALTH AND SAFETY OF THE STATE OF PENNSYLVANIA. Compiled for the State Board of Health. Harrisburg, 1888.

THE MICROSCOPICAL STRUCTURES OF IRON PYRITES. By Alexis A. Julien, Ph. D. Reprint.

ON THE VARIATION OF DECOMPOSITION IN THE IRON PYRITES, its cause and its relation to density. Parts I and II. By Alexis A. Julien. Reprint.

THE DECAY OF THE BUILDING STONES OF NEW YORK CITY. By Dr. Alexis A. Julien. Reprint.

ON THE GEOLOGY OF GREAT BARRINGTON, MASS. By Alexis A. Julien. Reprint.

MINERAL AND THERMAL SPRINGS OF CALIFORNIA. By W. F. McNutt, M, D. Reprint.

The Pope Manufacturing Company, of Boston, send us their Columbia Calendar for 1889. This consists of a pad, with dates, quotations and memoranda space, mounted on a neat, gilded stand. It is both serviceable and attractive.

CORRESPONDENCE AND QUERIES.

CORRESPONDENTS IN ANSWERING QUERIES WILL PLEASE REFER TO NUMBERS ONLY.

6. (ANS.)—Place the slide on a turn-table, and, with a sharp-pointed knife, turn off the cement over and at the edge of the cover-

glass. Carefully loosen the cover-glass so that water can pass in, and hen lay the slide flat in a dish of soft water until the glycerin has thoroughly diffused with the water. Carefully remove the cover-glass (under water) and float the specimen off by aid of a camel's hair brush. You can remount such specimens in glycerin or any other medium that is suitable.

H. M. WHELPLEY, St. Louis, Mo.

PITTSBURG, PA., December 13th, 1888.

DEAR SIR :—Through kindness of my friend, Dr. Frank Slocum, I enclose the following description of Guanidine Carbonate, which I exhibited at the late meeting of the I. C. M. S.

Guanidine is a monoacid polyamine ($CH^5 N^3$), was discovered by Strecker in 1861, being produced by the action of hydrochloric acid and chlorate of potash on guanine. There have been several methods devised since then to produce this substance artificially, but none have proved practical until Prof. Volhard, early in the '70s, produced it by simply heating sulphocyanide of ammonium in retort to 180°–190° centigrade for 20 hours, dissolving the residue in water, adding potassium carbonate, evaporating to dryness, dissolving in alcohol and crystalizing therefrom; this gives pure guanidine carbonate $[(CH^5 N^3)^2\text{-}H^2CO^3]$. The free base, guanidine, will, as shown in the process of its formation, decompose potassium carbonate, is the strongest known organic base, absorbs moisture and $C O^2$ from the air with as great avidity as caustic potash. Its main interest from a scientific point of view, is its strong basic properties. The numerous salts and compounds which can be produced from it, and especially the fact that it adds one more link of vantage to the production of uric acid artificially, the accomplishing of which will be a great step forward in the branch of medicinal chemistry, as well as a great discovery.

Truly yours, W. J. PRENTICE.

9. Does carmine, used in staining wood sections, require a fixative, and if so, what?

10. For mounting stained sections of wood, which is the preferable medium, balsam or glycerine jelly?

A. B. M.

11. Why is carbolic acid used in mounting insects, and what are the objections to its use?

12. Where can I find instructions for mounting insects without pressure? D.

13. Please mention some of the most important tests, and state the objectives for which they are tests? S. E. C.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS *who have microscopical apparatus, material or books which they wish to exchange, and such wants will be* INSERTED FREE OF CHARGE. *The number of insertions given will depend upon the number of exchanges received each month. Subscribers will please notify us when articles have been exchanged or sold. Dealers are referred to our advertising department.*

FOR SALE CHEAP—Bunsen's Spectroscope, cost $75. For description and price, address H. S. JEWETT, M. D., 215 Ludlow St., Dayton, Ohio.

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PROF. H. M. WHELPLEY, St. Louis, Mo.

MINERALS AND ROCKS from Utah and adjoining regions; fine nodules, some polished and others rough; concretionary limestone, etc. In exchange for good miscellaneous mounts. Address
PROF. J. E. TALMAGE, 32 Centre St., Salt Lake City, Utah.

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C. S. BOYER, Elm, Camden Co., N. J.

WANTED—Vol. IV, Nos. 8 and 9. Address this office.

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F. L. CAUCH, Dental College, Cincinnati, Ohio.

WANTED—Flesh containing trichina. Will exchange good mounts for same.
J. C. FALK, 800 Morgan St., St. Louis, Mo.

FOR EXCHANGE—A $50 collection of Dr. A. E. Foote's mineral specimens (300), for a good microscope. Address H. A. MUMAW, M. D., Orrville, Ohio.

WILL EXCHANGE histological slides for other interesting slides.
A. F. BARNARD, Box 152, Oberlin, Ohio.

TO EXCHANGE—Diatomaceous earth from Nottingham and Calvert County, Md.; Los Angeles and Santa Monica, Cal., and Richmond, Va., for other diatomaceous material, crude or cleaned, recent or fossil (marine preferred), or for diatom or miscellaneous slides. None but good mounts wanted. F. W. DUNNING, Battle Creek, Mich.

FOR EXCHANGE—Good histological or pathological mounts in exchange for other good mounts or material, general or special.
S. G. SHANKS, M. D., 547 Clinton Ave., Albany, N. Y.

WANTED TO EXCHANGE—For anything in the microscopical line: A $60 binocular telescope (field-glass), the Microscopical Dictionary, and other surplus goods. 1,500 objects. E. C. HOYT, 151 Howard St., Detroit, Mich.

MAMMALIAN HAIRS—First class mounts, to exchange for diatoms and other hairs. Lists exchanged. W. J. MARTIN, Davidson College, N. C.

FOR SALE OR EXCHANGE FOR OTHER BOOKS—A complete set—90 volumes—and odd volumes of Pennsylvania Geological Reports of Second Survey.
CHAS. LE R. WHEELER, 433 Adams Ave., Scranton, Pa.

WANTED—The following back numbers: THE MICROSCOPE: Vol. II. No. 1. *The Microscopical Bulletin:* Vol. I, No. 5, August, 1884; Vol. II, No. 1, February, 1885, and No. 5, October, 1885. For any of them I will send a well mounted and interesting slide for each number sent me. M. S. WIARD, New Britain, Conn.

FOR EXCHANGE A good collection of shells, mostly American species (especially Californian). Wanted—Microscopical books, papers, material, apparatus, etc. Send description of what you have to exchange. Have also collection of duplicates of above shells to exchange for same, or will sell both cheap for cash.
G. R. LUMSDEN.

FOR EXCHANGE OR SALE—Good histological or pathological mounts. Only good slides in any branch of microscopical science desired in exchange. For sale—1 B. & L. Universal Stand, with glass stage, iris diaphragm, neutral tint camera lucida, oculars A and C, last out, with micrometer, double nose-piece, professional objectives, 3-4 and 1-5 inch, Griffith's focus indicator, mahogany case, 1 Griffith club microscope, oculars B and D, student objectives 3-4 and 1-5 inch, in case, all in excellent condition. Also a B. & L. mechanical stage, perfectly new.
WM. N. BEGGS, M. D., 6 N. Beaumont St., St. Louis, Mo.

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VOL. IX. DETROIT, MARCH, 1889. No. 3

ORIGINAL COMMUNICATIONS.

ON THE EMISSION OF A COLORED FLUID AS A POSSIBLE MEANS OF PROTECTION RESORTED TO BY MEDUSÆ.

J. WALTER FEWKES.

IN THE year 1880 I described* in the ectoderm of the covering-scales of a medusa belonging to the family of *Agalmidæ*, which was found at Villa Franca, Southern France, very peculiar pigment bodies, which discharge their contents into the surrounding water when the scales are broken from the axis of the animal.

Since my description of these bodies no one seems to have studied them up to the present year (1888), when Dr. Bedot, in a valuable paper on *Agalma clausi*, sp. nov., quotes my account, and again calls attention to these bodies.

Since my observation was published, although I have studied many other genera of Physophores, I have found but one which exhibits this phenomenon of the discharge of coloring matter from its body when irritated. This is the genus Stephanomia (*Forskalia auct.*) which was observed to emit a similar coloring matter from its tasters. I can hardly doubt that in both cases we have a similar process which may possibly be a means of defense for the Physophore, which exhibits this peculiar phenomenon. My original description of these colored glands on the covering-scales or bracts of Agalma is as follows :

* Bull. Mus. Comp. Zool., Vol. VI, No. 7.

"There are very interesting highly refractile red spots of a problematical function covering the bracts in *Agalma sarsii* and *Agalma clavatum*. * * * The spots on each side of a central line are arranged on every scale in irregular rows, extending longitudinally across the bract, each pigment spot being enclosed in a cell. These peculiar pigment spots of the covering scales, represented also in some genera, as in Apolemia, by elevations composed of clusters of cells on the surface of the bract, are the most apparent structures in the transparent tract of *A. sarsii*, since, with that exception, there is hardly any coloration in the covering-scale. In *Agalma clavatum*, the sexually mature young of *A. sarsii*, only four rows of these pigment spots occur, as Leuckart has shown. When the bracts which bear these paralleled rows of spots are detached from the axis, their color changes to yellow, and a fluid of the same color exudes into the surrounding water. I have not been able to find in the descriptions by other naturalists any mention of this rupture of the cell wall and discharge of a yellow fluid when the bract is detached. I think these scale-cells belong to the ectodermic layer."

Bedot in his account of *A. clausi* finds similar glands in this species, but was unable to find them in *Agalmopsis sarsii*. It seems possible that in my account I may have confounded the two species, as others before me, and that the species which was observed to discharge the coloring fluid is that separated from *A. sarsii* under the new name, *A. clausi* Bedot.

Dr. Bedot also finds that the detachment of the scale is not necessary for the discharge of the coloring matter, and from the fact that only the anterior bracts of the colonies have this colored pigment in the glands, reasons that the posterior covering scales had evacuated their coloring matter, "au moment où l'Agalme a été capturée." His conclusion is undoubtedly well founded, and in support of it I may mention an observation, never recorded by me, that I have seen a discharge of the color from bracts still attached, and while the animal was alive. I have also observed that it is only when disturbed that this coloring fluid is discharged from the glands.

Nor is the discharge of a coloring matter limited in the Physophores to the colored glands* of the bracts. The same or similar colored discharge takes place in another genus from certain organs called tasters, which have open extremities. This phenomenon is recorded by Haeckel in Forskalia, and I have also observed it in a

* The term "gland" is preferable to "cell," by which in my original account these structures were designated, as Bedot has already pointed out.

species of the same genus, Stephanomia, from the Atlantic. When irritated, these organs can be made to throw off a colored fluid which calls to mind the discharge from the surface of the bracts of Agalma. Haeckel says,* "When a quietly floating Forskalia is touched, it suddenly discharges the contents of the chromadenia [pigment glands], and makes the surrounding water dark and intransparent." Kölliker also mentions this discharge of coloring matter from the "Fühler," and the same is described by Leuckart. These last mentioned naturalists regard the discharge, however, as due to a rupture of the wall of this organ rather than an emission from an opening, and the former says of it,† "Ohne Zweifel ist diese Substanz ein Excretionstoff, doch wird ohne genauer Kenntniss ihrer chemischen Beschaffenheit nichts Näheres über ihre Bedeutung beizubringen sein."

Haeckel offers the following explanation of this phenomenon in Forskalia: "The execretion of the pigment-masses and the darkening of the water by it have probably the same physiological function as in the Cephalopoda—to protect the attacked animal from its persecutors, and facilitate the capture of food animals." The suggestion may apply also to the pigment glands of the bracts of *A. clausi*, and the situation of these bodies on the bracts is very favorable to such a function. In no case, however, have I observed that the amount of the discharge is large enough to completely darken the water, although it is not impossible that the fluid thus emitted may be of a poisonous nature and therefore fatal to the small animals, the food of the Physophore, with which it comes in contact. The absence of these glands on the nectocalyces and its presence on those organs adjacent to the tentacles is significant, and would seem to have some weight in our judgment of their physiological function.

Although the hydrophyllia or bracts of the Siphonophores are so large and prominent in all medusæ, where they are present, no satisfactory explanation of their function has yet been proposed. They are commonly stated to act as coverings to the polypites and gonophores—a function which they may in part perform. In many cases, also, as in the Anthophysidæ, they assist in locomotion, as I have elsewhere shown in an Athorybia from Dry Tortugas, Florida.

It is not impossible, however, that they may be regarded as organs of respiration, for which they seem from their form well suited. In those genera where they are wanting, we generally have an enlarged float, and the possibility of *aerial* respiration, as in Vellidæ, Rhizophysidæ, Physaliadæ, etc., or as in Physophora and

* Report on the Challenger Siphonophoræ.

† Siphonophoren von Messina, p. 8.

the new order of Auronectæ Haeckel, an enlarged axis by which the polypites and other organs are brought into contact with the water. Respiration probably takes place over the whole surface of the body in all the Medusæ, aerial by means of an elaborate tracheal system in Velella or the enlarged float in Physalia and Rhizophysa, or aquatic through the covering scales, nectocalyces and other organs in Agalma and others. If the function of respiration belongs to the scales, it may be well to inquire whether the color cells have any relation to it. Their absence in most Physophores would seem to have a negative bearing in an answer to this question.

The covering-scales have been homologized with portions or fragments of swimming-bells. A. Agassiz compares them in Nanomia to the spheromere of a gelatinous bell, and finds in Hybocodon a medusa presenting an asymmetrical reduction of its bell, which is significant in the determination of their homology. The genus Athoria of Haeckel would seem to show that the covering scales are homologous to the apex of a medusa bell, for in this genus we have a bell cavity with radial tubes at the distal tip of a well developed bract. Accepting this interpretation, the central canal would seem to correspond perfectly, not with the *radial* canal as A. Agassiz's theory would necessitate, but with the *central apical* canal of a larval medusa before its rupture from a hydroid, or the same *central* canal of a nectocalyx. The cluster of nematocysts at the free end of the scale would thus represent the remnants of the tentacles, to which homology the large size of the lasso-cells in the half developed scale adds some weight, as does likewise the character of the covering-scale of Eudoxia and Praya.

On the other hand it is worth our consideration, in the study of the homology of the covering-scale, to remember that in the genus Pterophysa we have lateral wings on the polypites and we may suppose if these lateral wings became very much enlarged we would have an organ very similar to the covering-scale of Agalma. On the other hand, if the covering-scale was reduced, it might readily be converted into a simple tubular body such as we find in certain forms of the tasters. We have then the probability that tasters and hydrophyllia are homologous, although their form is so different, and we see that in some genera they have the same power of discharging a colored fluid from certain glands. The structure of the base of the taster* of Nanomia is different from that of other Physo-

* The division of the taster of Physophores into three kinds—those with tentacles and closed distal ends, those with open extremities without tentacles and those which bear at their bases the sexual bells—seems necessary and requisite to designate the different functions which they appear to have. The so-called tasters of Nanomia would seem to belong to the second of these three divisions, or to the cytons of Haeckel's descriptions of the anatomy of the Physophores.

phores. It possesses a large bright red globule remotely resembling the float. An accurate description of this taster is yet to be made, for its histological structure has never been determined. One is, however, tempted to regard it as in some way connected with the glands of Forskalia, which discharge their contents when the animal is alarmed. I have never, however, seen this so-called oil-globule lose its contents, even when the taster is broken from its connection with Nanomia.

It seems not unreasonable to conclude that the discharge of a highly colored fluid by the scales of Agalma is in part a means of protection for the medusa, and it would seem natural to connect it with the function of excretion. We know so little about the character of the excretions, and the manner in which they are produced in Medusæ, that at present we can hardly definitely ascribe the special function to these glands. Possibly similar glands are found in other Physophores, and the excretion has not been recognized from the fact that it is not so highly colored as in *Agalma clausi* and Forskalia. The discharge of this fluid from a living animal, if it take place without rupture of the wall of the scale, would imply special excretory openings somewhere on the bract. One is tempted to search for such openings, if they exist, on the distal tip of the scale, when they would be homologous to the excretory openings known to exist on the bell margin of certain Hydromedusæ, as Metschnikoff and others have shown.

BOSTON, MASS.

CEMENTS, VARNISHES AND CELLS.*

H. N. LYON, M. D.

EVERY one who continues in a given line of work for a number of years gradually confines himself to the use of a few agents. It is especially so in microscopy, and in these few remarks on cements, varnishes and cells, I shall mention only those that I have adopted, after having tried many and met with many failures.

I have selected this subject because, to me, it is of great importance, and while I may not add anything to the existing knowledge of the subject, my testimony may be of value in helping to settle that vexed question as to what makes the best cement, varnish, or cell.

For some eight years I have been experimenting in this line and the experiment which finally settled the question, in my mind,

* Read before the State Microscopical Society, January 11th, 1889.

was made in an unexpected way. Some years ago I packed my collection, numbering at that time many hundred mounts, in a trunk, and took it with me on my wanderings. Altogether the collection traveled between 15,000 and 20,000 miles, mostly by rail. It fared badly, but I consider the loss as slight in comparison with what it taught me regarding the powers of endurance of the various cements, media, etc. For obvious reasons it is impossible to give exact figures and I can only give the general result. There were only a few slides or covers broken, but the number of mounts ruined by the covers coming off or separating so that air entered was very large. The cements which stood this test the best were gold size and the solid marine glue. Balsam mounts, which were strengthened by a ring of varnish, were but little affected, while those not so protected suffered greatly. None of the wax cells made, as described later on, lost their covers or separated from the slide, while a large number of those made by cementing rings of wax to the slide were spoiled. Shellac, not backed up by a tougher cement, gave out in almost every instance.

Gold size has been a favorite cement with me for a long time. Some eight years ago I procured a number of bottles from the Messrs. Queen & Co., and some that is still left seems stronger than when first bought. Gold size is simply linseed oil rendered very "*drying.*" There are, however, a number of different formulæ for its preparation, and when you find a sample that is of more than ordinary worth it is well to lay in a supply. The same holds true of all such material as is not liable to deteriorate with age. Gold size hardens by oxydation, and very slowly at that, so a sufficient length of time must be allowed for each coat to become hard. If it were not for the slowness with which it hardens it would make an admirable cell. As it must be applied in very thin layers it takes too long to make cells of any great depth, and unless they are carefully made they will eventually break down. I use gold size for dry mounts, to attach metal cells, to "back up" a more brittle cement, and, in fact, in all cases where it is possible to do so.

Another cement, which works well with me, is Shellac. It must be the genuine article, and not the resin compound that is frequently sold for it. Shellac I prepare as follows: Put a few scales of orange lac in a wide-mouthed bottle and cover with 95 per cent. alcohol. The bottle is placed in a water-bath and a gentle heat applied until the shellac is dissolved, when it is filtered through muslin or absorbent cotton, previously moistened with alcohol. If too thick, add more alcohol and continue the heating for a short time. The shellac

must be thin, as if thick it does not adhere as well. It will in course of time become thick from the evaporation of a portion of the alcohol, when it should be prepared afresh. The rule that cements and varnishes are deteriorated by being thinned after they have become thick by evaporation or oxydation has few, if any, exceptions.

If desired, the bleached lac may be used when the light orange tint of the other is an objection. This makes a colorless solution, but its adhesive powers are much less than those of the orange lac. It is prepared as follows: From the center of a stick of bleached lac select a few small pieces and dissolve them in absolute alcohol, by the aid of a gentle heat. The central portion is chosen as it has been less exposed to atmospheric influences, and the fresher the specimen the stronger will be the resulting solution. If the bleached lac can be procured fresh enough, it makes a very fair cement, but if old it may be insoluble.

Bell's cement and liquid marine glue are shellac cements, and seem to be no better than the simple alcoholic solution.

Shellac works well on glycerin mounts, as a varnish for the inside of wax cells, to attach the cover-glass, and especially is it valuable as the first coat, when it is desired to "ring" a balsam mount. Being of the same color as the balsam, if any should run in, it mixes readily with it and is not noticeable. As it dries so rapidly when thin this seldom occurs. I always finish balsam mounts with a ring of varnish, as they look neater and last much longer. By the use of shellac no time need be lost in allowing the balsam to harden, but the mount can at once be put on the turn-table and a ring of shellac run around the edge of the cover. In ten minutes this will be hard enough to receive a coating of white zinc, Brunswick black, or some other quick-drying varnish, and in twenty-four hours the mount can be safely entrusted to the mails.

Shellac is too brittle to be used alone as a cement, and must always be backed up with some more tenacious varnish.

White zinc is my favorite in glycerin mounts, but it is far from being perfect. Glycerin is almost a universal solvent, and after a time the white zinc will crumble. This can be greatly retarded by giving the mount a fresh coating every two years. Unless well made this cement is worthless. It is the oxide of zinc suspended in a solution of damar in benzol. The bottle must frequently be forcibly shaken to keep the mixture uniform. It should be used as thick as possible, or on drying there will not be enough of the damar to prevent crumbling. As the benzol is very volatile the solution must be used rapidly. The secret of its use is that it must be used

quickly, the bottle must not be left open, and it must not be too thin. Aside from its use in glycerine mounts I only use white zinc as a finish. Some of you probably remember the controversy between Mr. Hitchcock and Dr. Stowell regarding the merits of white zinc. As I have a number of mounts sent me by Dr. Stowell which have given out, I must add my testimony to that of Mr. Hitchcock. However, until something is found which will permanently confine glycerin, I shall continue to use the white zinc, as I think it is the best cement we now have for that purpose. If care is taken to remove all traces of glycerin from around the edge of the cover before the cement is applied, and each coat allowed to become thoroughly dry before another is applied, you can expect a good mount.

Other fluids than glycerin I seldom use. I find, however, that one or the other of these three cements will confine almost any fluid liable to be used.

First on my list of varnishes is white zinc. This I use for its color alone, as it is apt to become brittle with age. My usual finish is a broad ring of white zinc, with one or two narrow stripes of Brunswick black.

Brunswick black makes a very satisfactory finish, as it dries a glossy black, and does not chip. It makes a very pleasant contrast with the white.

Occasionally I employ a red varnish made by dissolving the best red sealing-wax in alcohol. This gives a bright red varnish that stands well. The best sealing wax must be used as the cheaper kinds are brittle.

Shellac I use to varnish the insides of cells, and to support old mounts that have begun to give way. Being colorless it does not destroy the individuality of the mount. By adding an alcoholic solution of an anilin to a solution of orange lac, and evaporating until of the proper consistency, a very brilliant varnish may be made. If exposed to a strong light these varnishes are apt to fade.

For very shallow cells I employ gold size. If deep ones are desired, I prefer wax, paper, and glass or metal rings. In a few instances I have had good results from cells made of asphalt and baked before being used. It is essential that the genuine asphalt be used and not the coal-tar product.

Cement cells must be built up one coat at a time. If the second coat is added before the first is perfectly hard, the cell will eventually break down.

The best cell that I have found for dry mounts is made by punching a hole in a piece of blotting paper of the proper size and

thickness. This is cemented to the slide with mucilage. A paper "front" must be used, for, if a varnish is used it will defeat the object of the paper cell. If sweating should occur in one of these cells, which only happens in exceptional cases, it is only necessary to lay the slide on the warm table and apply a gentle heat. As soon as the blotter is dried out it will absorb all the moisture that may be in the cell.

For balsam mounts I use brass curtain rings, cemented to the slide with gold size, and well varnished on the inside with the same.

For dry mounts which are not liable to give off moisture, I employ wax cells. They are quickly made and are very strong. My method is as follows: A piece of single-thick sheet-wax, such as is employed in making artificial flowers, is put on the centre of a slide and held there by pressing the ball of the thumb against it. The heat of the hand is just sufficient to make it adhere. When the first piece is firmly attached, which can be told by the absence of air bubbles when viewed from below, a second piece can be added and secured in the same manner. In this way cells of any depth can be made. When the wax is of the required thickness the slide is placed on the turn-table and with a sharp scalpel a cell is "turned" out of the mass, as a turner fashions a bowl in his lathe. A damp cloth on the end of the finger or a small stick, is used to clean the glass inside the cell. The wax must be well varnished, or the volatile portions will escape and collect in fine beads on the under surface of the cover. Wax cells made in this way seldom become loosened from the slide, even when roughly handled.

Glycerin mounts I put up in glass cells. As these should be attached to the slide with the solid marine glue, it is better to get them ready prepared. I secure the covers with shellac, as it is less liable to run in than white zinc. These mounts afterward receive a coat of white zinc as a safeguard.

You will notice from these remarks that I am an advocate of the wax cell and shellac varnish. The merits of the latter are now pretty generally known, and if once used it is not apt to be discarded. It must not be trusted to alone, as it will not stand sudden jars. The wax cell is still a disputed subject. I know they are liable to sweat, but I think I can safely hazard the statement that not one dry mount in fifty, not put up in an absorbent cell, will show an unclouded cover after a few years. Objects of the mineral kingdom alone do not give off vapors.

Again, we must not lay the defects of the cover-glass itself to this cause. If you examine carefully a number of cover-glasses,

taken from different packages, you will find quite a proportion show an appearance resembling minute beads of moisture on the surface. This is due to a roughness of the glass, which prevents the light from passing through properly. If such glass is used on balsam mounts the defect is not noticeable, but if used for dry mounts an amount of sweating that would ordinarily be of little moment will so intensify the effect that the mount is declared ruined and the cell gets the blame. My experience with wax cells has been very great, and when carefully prepared I do not think they are any more liable to sweat than any form of cell that is hermetically sealed. If it were possible I would put up everything in a solid medium, such as balsam or Farrant's solution. Such preparations will remain long after those dry or in fluid have been thrown away.

272 THIRTY-FIRST STREET, CHICAGO.

MICROMETER MEASUREMENTS.

M. D. EWELL.

IN MY last communication I advocated the use of metal micrometers *uncovered*, stating, however, that if necessary a temporary cover could be used. In the same connection I ought to have stated that if such a temporary cover should be used, it should always be used under precisely the same conditions, and the observer should be quite sure that both faces of such cover are parallel, otherwise the influence of refraction, the cover acting as a prism at some part of its surface, might introduce errors of unknown magnitude. For this reason, on further reflection, I think it better to have a permanent cover on micrometers intended for use with high power objectives, and to have the corrections of such micrometer determined with such cover *in situ*.

This leads me to notice a table of measurements some time since published by Mr. Chas. Fasoldt, which I suppose was intended to invalidate the result of the investigation of Centimeter Scale "A" and its so-called copies, by the different observers who have investigated them. Mr. Fasoldt does not in his published paper give sufficient data to enable one intelligently to criticise or judge of the accuracy of his work ; but there is one element of uncertainty about it that seems quite patent, viz: that *it does not appear that the glass disc upon which the lines were ruled had either surface plane or that the two surfaces of the said disc were parallel.*

If nothing else appeared, to my mind the fact that the space was measured with different sorts of illumination, and with the

lines first downward and then upward, thus introducing *unknown errors* due to the causes above specified, would deprive the results of any value they might otherwise possess. There is no means of intercomparison and of eliminating these unknown errors.

I cannot ascertain, however, from the paper, with what standard the $\frac{4}{10}$ inch was compared, or exactly how it was compared. If, as I suppose, it was compared with the screw of a screw stage micrometer, which was assumed to be a constant, I must beg to dissent from any conclusion thus obtained. I find it necessary, in ruling standards of any considerable length, to assume a value for the screw, rule a trial scale, and by actual comparison with some *authentic* standard deduce therefrom a series of corrections before ruling the final scale. If great accuracy is desired, it may be necessary to repeat this several times before ruling the final scale; and this is the case notwithstanding the errors of the screw have previously been carefully investigated. I would never trust any screw or train of wheels as a final *standard* of reference for more than about one-half the field of the microscope, much less for so long a space as $\frac{4}{10}$ inch.

I do not think therefore that the results of the measurements of Mr. Fasoldt are entitled to any weight whatever, as invalidating the final correction of "A" and its so-called copies, if they were intended for that purpose; and indeed I cannot see that they have any scientific value whatever, in the absence of more precise information as to the conditions under which they were made. Under precisely identical conditions, so far as they can be commanded, some slight variation between different single measurements is to be expected; but the substantial agreement existing between the results arrived at by independent observers, at widely different times and places, is not to be invalidated by discordant results obtained by one observer under different conditions.

Centimeter scale "A" was investigated by all the observers under substantially the same conditions; and the copies by Mr. Fasoldt were necessarily compared with it under similar conditions, viz: by the use of a Bausch & Lomb opaque illuminating objective, so that if any errors were introduced by the fact that the lines of Mr. Fasoldt's copies are on the under side of the cover-glass upon which they were ruled, *these errors are constant* and are the same as if the scales in question were ruled with these errors incorporated in them. It should be remembered always that "A" is uncovered, and that the Fasoldt copies are permanently mounted, the lines being on

the under side of the cover-glass. "A" is not intended to be used with a cover, nor are the copies to be used uncovered.

I append in a note below the table of measurements by Mr. Fasoldt, in order that your readers may have the means of judging whether my criticisms are just. The reader is also referred to the investigations of these various scales hitherto published in the proceedings of the American Society of Microscopists, which should be accessible to every person who owns a microscope.

CHICAGO, 1889.

MEASUREMENTS BY CHAS. FASOLDT, SR.

Table showing the variation in measurements due to the different applications of light and illuminations.

The image of $\frac{4}{10}$ inch was the object on which these measurements were made, and was ruled on a glass disc of No. 2 covering glass, $\frac{7}{1000}$ inch in thickness.

All measurements were taken on one and the same ruling, with the same microscope, objective and eye-piece, under the same focus, and having the microscope in the same position continually, and only changing the mirror and excluding the one light while the other was used.

UNMOUNTED.

LAMP LIGHT.

LINES DOWNWARD.		LINES UPWARD.	
Concave Mirror, . .	$\frac{4}{10}$ in. $\frac{10}{100000}-$	Concave Mirror, . .	$\frac{4}{10}$ in. $\frac{10}{100000}+$
Plane " . .	$\frac{4}{10}$ in. $\frac{5}{100000}+$	Plane " . .	$\frac{4}{10}$ in. $\frac{14}{100000}+$
Ill. through objective,	$\frac{4}{10}$ in. $\frac{5}{100000}+$	Ill. through objective,	$\frac{4}{10}$ in. $\frac{15}{100000}+$

MOUNTED ON GLASS.

LAMP LIGHT.		DAY LIGHT.	
Concave Mirror, . .	$\frac{4}{10}$ in. 0	Concave Mirror, . .	$\frac{4}{10}$ in. $\frac{30}{100000}+$
Plane " . .	$\frac{4}{10}$ in. $\frac{15}{100000}+$	Plane " . .	$\frac{4}{10}$ in. $\frac{20}{100000}+$
Ill. through objective,	$\frac{4}{10}$ in. $\frac{31}{100000}+$		

A number of comparisons were made at each position and in the same temperature.

A Spencer objective was used for these measurements. But Bausch & Lomb and Gundlach objectives were also tried, obtaining the same results.

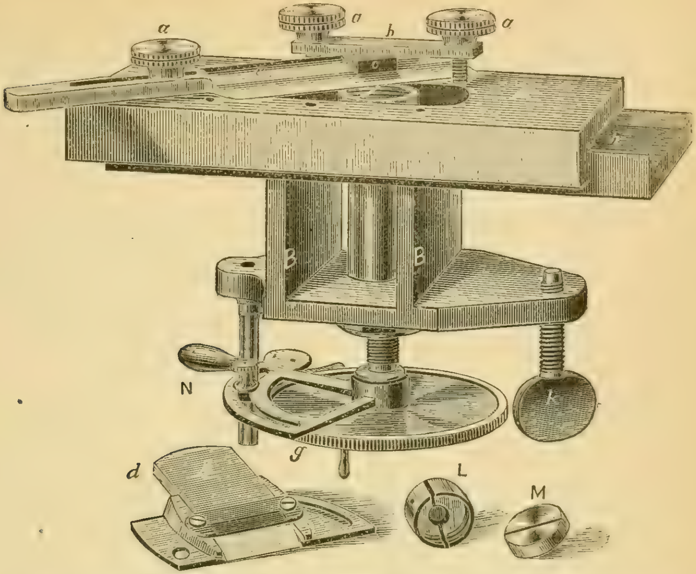
The microscope used is one constructed on my late patents, and has a micrometer for measuring similar to a cob-web micrometer. But instead of cob-webs, three movable steel pointers are used, which are worked as fine as this metal will permit. The stage is mechanical, and the main slide is moved with great precision by a fine screw 100 threads per inch.

THE KING MICROTOME.—NUMBERS 1 AND 2.

J. D. KING.

THIS microtome claims no superiority over other first-class instruments for ordinary histological work in animal tissues, but it is designed especially for hard service in botanical work or for

cutting any hard material, which requires absolute rigidity in the instrument.



The knife is attached to a heavy nickel-plated iron carriage, *A*, by a steel clamp and shoe, *b* and *c*, with milled-head screws, *a*. The carriage runs on a solid iron track, *h* and *B*, which is held to a table by clamp screw, *k*.

For cutting very hard objects, like the wiry stems of plants, or the chitinous skeletons of insects, there is an attachment with a very stout blade, on the principle of a carpenter's plane, *d*, which screws on to the carriage in place of the knife, and like the knife it can be used straight across or obliquely.

Microtome No. 1 gauges to $\frac{1}{10,000}$ inch, and it will cut paraffin or any object imbedded in it, that can be cut that thickness. Now as a matter of fact, sections of $\frac{1}{10,000}$ inch are seldom wanted, except to show the skill of the "artist," but this fineness of feed will enable the operator to graduate the thickness of the section just to his liking.

No. 2 gauges to $\frac{1}{2000}$ inch, and meets all the common requirements of the botanist.

The King Microtome should not be confounded with "King's Providence Microtome," which is not now in the market; the principle is the same, but the mechanism has been very much simplified and improved, and the workmanship is first-class.

Full directions for use accompany each instrument.

EDGARTOWN, Mass.

COPAL CEMENT.

W. Z. DAVIS.

AT THE last meeting of the American Society of Microscopists Dr. F. L. James made some remarks in regard to a clear copal varnish made by himself. The substance of Dr. James' remarks was recently published in the *Microscopical Bulletin*. He disclaims entire originality in his formula.

As I have for some time, before I knew of the process of Dr. James or any other person, used a copal cement and varnish made by myself, I give to the readers of THE MICROSCOPE the result of my numerous experiments, although I have never been at the pains to reduce it to an exact formula.

Take best clear copal gum coarsely pulverized, and mix with a sufficient quantity of benzol to cover it, and let stand for twenty-four hours. The benzol will not dissolve the gum, but is a valuable aid in making a perfectly clear varnish. Take of chloroform twice as much as the benzol and dissolve in it enough gum camphor to saturate the chloroform, and then add a small quantity of pale linseed, nut, or poppy oil. The quantity of oil will vary, as a quick or slow-drying cement is desired. If no oil, or a very small proportion, is added, the cement will dry very quickly. A larger quantity of oil makes a slow-drying preparation of much greater toughness. Next add this mixture to the copal and benzol, shaking at intervals for several days, until as large a quantity as possible of the gum has been dissolved. Pour off, filter, and evaporate to any desired consistency.

This makes a perfectly transparent and colorless cement, useful both as a finishing varnish and for cell building. It adheres exceedingly well to glass, especially if the glass is warm when the first coat is applied. I have block-tin cells so firmly fixed to the glass by it that it seems scarcely possible to push or jar the cell from its place without breaking the glass. Cells built up entirely with the cement are as colorless as the glass itself, and when *thoroughly seasoned*, as all cells should be, are handsome, durable and of as wide a range of usefulness as any material known, not excepting gold size.

I formerly used ordinary copal varnish, diluted with equal parts of benzol and chloroform, and after standing some time in bottle, with animal charcoal (in small lumps) filtered through paper. This varnish has a little color when used cold, and when a cell made of it is slightly heated on the slide it becomes of an amber color.

Yours sincerely
Henry Mills

The value of copal gum in microscopy is so great that any suggestion which tends to make its use both practical and convenient is worth considering: and this is my apology for calling the attention of your readers to my somewhat crude methods.

MARION, Ohio.

HENRY MILLS.

D. S. K.

THIS venerable and highly esteemed contributor to THE MICROSCOPE, died after a brief illness February 7, 1889, in Chattanooga, Tenn., at the age of seventy-six. Mr. Mills was on his way to Florida, where he hoped to escape, as in previous years, the rigors of climate incident to his Northern home.

He is best known to the readers of this journal by his work on the Fresh-Water Sponges. Twelve or more years since, he retired from business and spent much of his leisure thereafter in collecting and studying these forms. This search had been carried on, not only about his home, Buffalo, N. Y., but in Florida, Pennsylvania, Ohio, Illinois, Wisconsin and Dakota. He was successful in greatly extending our knowledge of the distribution and habits of our species; he also gave the first notice and description of several new and unique species or varieties. Mr. Mills was not a species-maker, and often withheld a long time a description from publication, or in several instances sent his material and suggestions to others for publication. Those of us who, knowing him intimately, know that his modesty was equal to his worth, can understand this.

Success achieved in another direction, gave him the keenest pleasure and satisfaction, viz: that he had been able to assist others in getting a start in the study of nature with the microscope. In the progress of such he rejoiced as one may at the advancement of his own children. The writer of this note is one of many who has benefited by his advice, been inspired by his enthusiasm, led to respect him for his genuine manhood, and now revere his memory.

Mr. Mills was one of the first to efficiently use the microscope in Buffalo. He was the first Curator of Microscopy, Buffalo Society of Natural Sciences (1872); one of the founders of the Buffalo Microscopical Club (1876), serving almost constantly on its Board of Managers, one year as President, and contributing largely to its proceedings; he was a member, joining in 1879, of the American Society of Microscopists.

The subject of this sketch was an honored member of the Baptist Church, known and respected by all as a pure man and an honest man.

PROCEEDINGS OF SOCIETIES.

THE ST. LOUIS CLUB OF MICROSCOPISTS.

THE St. Louis Club of Microscopists had a full attendance at their regular monthly meeting for January, which was held at the St. Louis College of Pharmacy, the 8th ult. After some discussion it was decided to subscribe for all the journals of microscopy in the world, and Messrs. J. C. Falk and V. Shaler were appointed to attend to the business. A committee on constitution and by-laws, consisting of D. L. Haigh and A. C. Speth was appointed. According to a resolution passed, a fine of ten cents will be imposed on each member every time he is absent. J. B. Whinery was elected a member.

Professor H. M. Whelpley read some practical notes from the *Microscopical Laboratory*, which were accompanied by specimens. Frank Davis reported on the examination of commercial carmine for starch, and stated that but one adulterated specimen had been found and that was a cheap grade of carmine, not claimed to be pure.

D. L. Haigh is on the programme for February meeting, and arrangements are being made for each meeting in the year.

THE KENT SCIENTIFIC INSTITUTE.

THE following is the list of the officers of the Kent Scientific Institute, of Grand Rapids, Mich., for 1889 :

President, E. S. Holmes; Vice-President, W. A. Gruson; Recording Secretary, C. W. Carman ; Corresponding Sec'y, E. S. Holmes ; Treasurer, C. A. Whittemore ; Director of the Museum, W. A. Gruson ; Curator, C. W. Carman ; Librarian, E. L. Moseley.

Board of Directors :—Wright L. Coffinberry, W. A. Gruson, Sam'l L. Fuller, E. S. Holmes, J. W. Jones, C. A. Whittemore.

Officers of the Board :—Chairman, W. A. Gruson ; Secretary, E. S. Holmes ; Treasurer, C. A. Whittemore.

E. S. HOLMES, *Secretary.*

CARNOY MICROSCOPICAL SOCIETY.

NOTRE DAME, INDIANA.

AT OUR last session, the subjects of polarized and reflected light were developed, and a paper on micrometry was read by one of the members. The members this year are, for the most part, beginners.

T. A. FLOOD, *Secretary.*

ELEMENTARY DEPARTMENT.

A COURSE IN ANIMAL HISTOLOGY.
NINTH PAPER.

FRANK W. BROWN, M. D.

MUSCLE.—There are three forms of muscle: (1) Striated, or voluntary, (2) Non-striated, or involuntary, and (3) Cardiac muscle.

STRIATED MUSCLE.—Take a shred of muscle from the leg of a frog or other animal, tease out thoroughly in the salt solution, and examine with a low power. The fibers, having a diameter of about $\frac{1}{500}$ of an inch, are easily made out. Careful search will show parts of these fibers transversely marked or striated. These striations are very characteristic and should be studied. Examining at different foci, it will be seen that the striæ run clear through the fiber. Once recognized, they ought never to be mistaken for anything else. Less marked and less numerous are the longitudinal striations, generally found where the cross striations are not visible. Certain fibers may show no cross striations, but may appear like bundles of fibrous tissue, owing to the existence of numerous longitudinal markings. These longitudinal markings show the divisions of the fiber into primitive fibrils. With a somewhat higher power study the ends of the fibers or parts in its course where the muscle substance has been injured. A homogeneous membrane may be found. This membrane—*the sarcolemma*, invests each muscle fiber. It is apparently structureless and highly elastic. Irrigate the specimen with dilute acetic acid. The striations become more prominent and numbers of spindle-shaped nuclei appear. These nuclei are situated just under the sarcolemma and are attached to it. Whether they are small, connective-tissue corpuscles belonging to the sarcolemma, or whether they are muscle nuclei is a question. Probably they are muscle nuclei, for in certain muscle (the red muscle of many animals) they are embedded in the muscular substance and are detached from the sarcolemma.

Place a portion of muscle in a solution of chromic acid ($\frac{1}{200}$) where it should be left to harden. When teased out in the salt solution it will be seen that the fibers have become split up into primitive fibrils. The cross markings are still visible on the fibrils.

Put another portion into an aqueous solution of H Cl ($\frac{1}{100}$). The fibers will be divided along the line of the cross striations, forming little plates or discs—Bowman's discs.

The minute histology of striated muscle has not yet been decided. The prevalent idea is this: The lighter striæ represent a cement substance, the darker ones the muscle substance. With a high power these dark striæ are seen to be divided by fine longitudinal lines. The substance between the longitudinal striæ on the one side and the cross striæ on the other is called a muscle-case. Within this case, which is bounded by an exceedingly delicate membrane, is a small, striated muscle body surrounded by an indifferent fluid.

Harden a piece of muscle in alcohol, embed in paraffin and make transverse sections. Stain slightly with borax carmine and mount in balsam. The arrangement of the fibers can be studied. Between them is a small amount of delicate connective tissue—the perimysium. With a high power the fibers themselves are found to be traversed with a delicate network—the so-called *areas or fields of Cohnheim.* The lines represent the cement substance between the primitive fibrils.

NON-STRIATED MUSCLE.—Fill the bladder of a good-sized frog with air, in order to define it, remove and place it in glycerin for two or three days. With a rather stiff camel's hair brush vigorously rub off the epithelium, stain in hæmatoxylin and mount in glycerin or balsam. Examine with a high power. Little bands of spindle-shaped cells constitute the muscle fibers. Each cell is fusiform, occasionally possessing branched processes, nucleated, marked with longitudinal striæ and about $\frac{1}{500}$ inch in length. It is not inclosed by a membrane. A bundle of this form of muscle fiber is composed of large numbers of these spindle cells held together by a homogeneous cement substance.

HEART MUSCLE.—Tease a portion of this muscle in the salt solution, stain with a drop of eosin solution and examine. The fibers, much smaller than the voluntary variety, are striated transversely and longitudinally; are very short and branched, usually at one end; contain a nucleus embedded in their substance; possess no sarcolemma and are held together by a cement substance and small quantities of fibrillated tissue.

Permanent preparations of muscle can be made according to directions given in the November number, in an excellent paper by V. A. Latham, and need not be repeated here. Learn to distinguish the various sorts of muscle, especially the non-striated variety, which so closely resembles certain connective tissues.

EDITORIAL.

MICROSCOPICAL OUTFIT FOR PHYSICIANS' USE.—We have received several letters from physicians, asking us what apparatus is required for making the ordinary microscopical examinations incident to medical practice. The use of the microscope is absolutely essential to the intelligent practice of medicine, and yet we fear few physicians even own an instrument, and of the few who, in the enthusiasm of their student days, purchased a microscope, not a small number make no practical use of it. In the latter case it is not always forgotten that, placed under a bell-glass where it can be seen, it has a most valuable moral effect on one's patients. But the day is coming when the physican who does not employ his microscope will fall behind in the race. If it were generally known how valuable an aid it is, and how simple and inexpensive are the necessary instruments and reagents, with which to prepare specimens for examination, we think it would be more widely employed.

Let the physician who owns a microscope, and does not use it, adopt this plan: Procure a pine table about three feet square, and place it near a window with a good light. Devote this table to your microscopical work and nothing else. Purchase a number of bell-jars of different sizes—from two to eight inches in diameter—under which are placed all instruments and glass-ware to keep them from the dust and, as they are in view, easily accessible. Obtain the following articles: a pair of needle-holders, fitted with needles; a scalpel; a pair of small sharp-pointed scissors; two pairs of forceps, one of which should have no teeth; a sharp razor; two or three pipettes; two dozen glass slides, and an equal number of one-half inch cover-glasses; several watch-glasses of different sizes (glass salt-cellars will do), a few test-tubes, and a sheet of paraffined paper. Of chemicals, get two ounces each of hydrochloric, nitric and acetic acids; aqua ammonia; ammonia carmine; an alcoholic solution of eosin, 30 grains to the ounce and a pint each of alcohol and distilled water. With the above material all ordinary work can be performed. If it is desired to test sputum for the bacillus tuberculosis, purchase in addition to the above, a porcelain dish; a tripod; an alcohol lamp, and two ounces each of aniline oil and a saturated alcoholic solution of fuchsin.

When a specimen is procured, put it at once into a bottle and cover with a little alcohol, or, if fluid, into a test-tube, and examine when at leisure. If you do not know how to prepare the specimen for

extemporary examination, make it a point to find out; it requires no genius to do this. If, which is likely, you are unable to make a diagnosis, read up in a good text-book containing good illustrations; this is dangerous, but you will probably get it right occasionally. Examine known tissues and substances, and remember how they look. When you get a chance, take a course in a good laboratory, to correct you where wrong and confirm you where right. But much can be done with perseverance, a text-book, and a little sense.

If the above course were followed by all the physicians in this country, who do not know how to use a microscope, there would be a marked change in the prevalence of certain diseases. Bright's disease, for instance, would become less frequent though more fatal, and bladder-specialists—if such there be—would wax fat on the abundant harvest caused by an increase of cystic catarrhs.

ACKNOWLEDGMENTS.—From W. H. Haskins, Cleveland, Ohio, three slides Salicin and Asparagin crystals. These make beautiful polaroscopic objects.—From Rev. J. D. King, Edgarton, Mass., slides Cellularia, Biscellaria, Bugula, Raby Star, Salutaria, etc.; also, samples of King's well known varnishes. We have already mentioned Mr. King's mounts as being exceedingly beautiful.

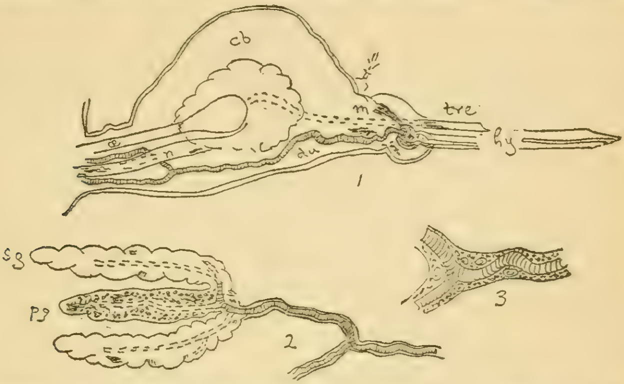
ZOOLOGY.*

THE POISON APPARATUS OF THE MOSQUITO.†—Professor I. Macloskie has been able to identify the poison-glands and ducts of the mosquito, thus complementing the previous work of Dimmock. The hypopharynx (Fig. 1) has a delicate tube running through it—the whole organ dilating at its base into a trumpet-shaped mouth, which is provided with a sac-like reservoir, into which the end of a fine duct is inserted. Tracing this duct backwards, Macloskie found that it presented the usual character of the salivary ducts in the Diptera, but much finer than usual, being less than eight microns in diameter. It has the usual chitinous lining, surrounded by the nucleated hypodermis which secretes it, transversely striated as in tracheæ (Fig. 3); but distinguished from the latter by the comparative smallness and constancy of its diameter, and by the absence of ramifications It runs back in the lower part of the head, beneath the nervous com-

* Under this heading will be included all Abstracts relating to the Embryology, Histology, etc., of Vertebrates and Invertebrates.

† Am. Naturalist, October, 1888, p. 884.

missure (n, Fig. 1), for two-fifths of a millimeter. In the throat it bifurcates, each branch being as long as the undivided segment, and running on the right and left of the nerve-cord into the prothorax, terminates in glands of characteristic structure. These glands are



in two sets, one on each side in the antero-inferior region of the prothorax; each set consisting of three glands, two of which resemble the usual salivary gland. The third gland, which occupies the center of each set, is different, being evenly granular, and staining more deeply than the others; its function being without doubt the secretion of the poison. Each gland is about one-third of a millimeter long, and one-twenty-fifth of a millimeter broad; the three are arranged like the leaves of a trefoil; and each is traversed throughout by a fine ductule, the three ductules uniting at the base to form a common duct, which is one of the branches of the bifurcated venomo-salivary duct. The ductules of the lateral glands of each set receive a minute branchlet near the base. Macloskie observed muscles (m, Fig. 1) apparently inserted on the framework of the reservoir, but Dimmock thinks that the hypopharynx is not furnished with muscles. However this may be, the pressure exerted on it by the surrounding parts, when the mosquito inserts its piercing apparatus into the flesh, or through the epidermis of a plant, is sufficient to propel the poison through the tubular axis of the hypopharynx into the wound.

Fig. 1. Median section of head: *du*, venemo-salivary duct with its insertion in (hy) hypopharynx; *œ*, œsophagus; *cb*, cerebrum, below which is the cerebellum; *tre*, labrum-epipharynx; *m*, muscle; *n*, nerve commissure.

Fig. 2. Venemo-salivary duct, showing its bifurcation and the three glands on one of its branches: *pg*, poison-gland; *sg*, salivary-gland.

Fig. 3. Bifurcation of duct, with nucleated hypodermis.

FAMILIARITY WITH EPITHELIUM NECESSARY IN BACTERIOLOGICAL RESEARCH.*—Barringer thinks that before taking up the study of bacteriology it is important that the student should acquire a knowledge of the different forms of epithelium which are found in various portions of the body.

In the study of the pathogenic bacteria, it might be thought that at last there is found one kind of work in which is escaped the onus of epithelial tissue detection ; but no, there is no form of pathogenic bacteria known that is not ordinarily found associated with certain epithelial cells. The gonococcus in the female is mainly on the squamous cells from the vagina; in the male, on the cylindrical cells of the anterior urethra. The bacillus tuberculosis is, practically speaking, always associated with the ciliated epithelium of the respiratory tract. The bacillus of Erbeth, as well as the comma bacillus of Koch in the dejecta of the bowel, float amongst myriads of the cast-off cells of the columnar type. If, then, these cast-off histological elements are to be our companions, wherever we go in microscopic research, it behooves us to get thoroughly acquainted with them. This we can only do by studying them class at a time, and observing both their morphological and chemical characteristics; for the beginner must know that it is not by *looks* alone that things microscopical are identified, but quite as often by the way in which they behave in the presence of certain reagents and stains. It is this chemistry of the microscope that has advanced the art in the last few years fully as much as has the improvement in lenses.

FRONTAL SAC OF THE MUSCIDÆ.†—Mr. W. Jenkinson differs from Lowne as to the connection of the frontal sac of flies with humming. Besides the brain, nerves, muscles, air-sacs, etc., the head contains a large quantity of fluid, which on coming in contact with the inner surface of the sac, would prevent any vibration of its walls. He finds from sections that the sac is used as a receptacle of the fluid contents of the head and proboscis, when the latter is drawn up toward and partially into the lower part of the head, emptying again as that organ is projected, thus maintaining a uniform pressure on the nerves, brain and muscles, whatever might be the position of the proboscis.

THE CONTRACTILE VACUOLE.‡—The dispute regarding the nature of the contractile vacuole in the protozoa is not at an end. Dr. De

* *North Carolina Medical Journal.*

† Hardwick's Science Gossip, December, 1888, p. 265.

‡ American Naturalist, December, 1888.

Bruyne records (*Bulletin Roy. Acad. Sci. Belg., LVI, 1888*) his belief that it does not communicate with the exterior, and that it is not possessed of excretory functions. Prolonged study tends to show that the contained fluid is not expelled from the protozoan, but that it is forced to other parts, to again return to form the vacuole. He would rather regard it as of respiratory and circulatory functions, and thinks that the contained fluid may possibly have nutrient qualities.

BOTANY.*

THE NUTRITIVE PROCESSES IN SACCHAROMYCES.† The study of the nutritive processes of these fungi has been undertaken by Vine, who describes, 1, the nature and condition of the nutrient material, and, 2, the manner in which such nutriment finds its way within the organism. The fact that various species of Saccharomycetes will thrive in other than saccharine fluids,—one containing mineral salts only, for example,—leads to the conclusion that whatever other materials may be absorbed, the cell wall must necessarily be pervious to certain inorganic salts. The cultivation of *S. cerevisiæ* in infusions of malt containing various amounts of ammonia or nitrogen salts, shows that the vigor of the cell and the process of multiplication is visibly increased by the mineral additions, though not always with regularity. On the other hand, in cultures in solutions of cane sugar, with or without the addition of nitrogen, and ammonia salts and alkaline phosphates, the vitality of the cells is *maintained*, but the increase of cells is limited and their vigor visibly declines. If these cells are now placed in a fresh sugar solution, they will exert but little decomposing action, and their vitality will come to a standstill. If they are now removed to a weak malt infusion, or a solution of sugar, either containing besides the saccharine matter, nitrogen and mineral salts, the cell-contents will again fill up the cells, and the process of multiplication will begin and continue as long as the cultivating medium remains suitable. Malt infusion deprived of its crystallizable nitrogen by dialysis, has about the same effect on the growth of the cells as the sugar solution. The author is of the opinion that compounds of an amide character play an important part, and that the suitability of a liquid as a nutrient medium for the growth of saccharomyces depends much on the amount of resolution in this

*Under this heading will be included all Abstracts relating to the various departments of Botany.

†Journal of Microscopy, Jan'y, 1889, p. 9.

direction which the organic compounds have gone. In answer to the second proposition, Vine has found that the cell-wall is possessed of elasticity and porosity, which no doubt vary according to the character of the environment. With this knowledge the observer experiences little difficulty in realizing that it may be readily permeated by nutrient material presented in suitable form, or further by excrementitious matter, the retention of which would be injurious.

MICROSCOPY.*

METHOD OF INVESTIGATING MUSCLE.†—In his researches on the regeneration of cross-striped muscle, Leven first injected Flemming's solution well into the muscle, then cut out a piece which, after further subdivision, was placed for some days in Flemming's solution, and finally hardened in absolute alcohol. Sections were stained in four to eight hours, by a solution of saffron, made as follows:

Saffron, 1 part.
Absolute alcohol, 100 parts.
Distilled water, 200 parts.

The sections were then washed in distilled water, and left in acidulated alcohol (O. 5 per cent. H. Cl) until they recovered their cle nuclei are pale with dark red nucleoli. Leucocytes take on the former yellow color. They were then treated with absolute alcohol, oil of cloves, and finally mounted in damar. If successfully done, the karyokinetic figures appear deep dark red, while the muscoloring matter more easily and keep it longer than the rest of the tissues, with the exception of the mitotic figures, a state of affairs very favorable for examination. The coloring altogether is so delicate and definite, and distinguishes so sharply between the various tissue elements, that any further staining is superfluous.

METHOD OF EXAMINING ANTS FOR INTESTINAL PARASITIC INFUSORIA.—Mr. J. W. Simmons cuts off the abdomen of the insect, places it in a drop of distilled water, and teazes. Cochran's crimson ink is recommended for staining the organisms, but any carmine ink would probably answer the purpose. Roseine is also useful. Osmic acid is employed for killing and fixing the infusoria.

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*Under this heading will be included descriptions of New Instruments, Microscopical Manipulations, Stains and Re-agents, Photomicrography, etc.

†Medical Chronicle, November, 1888.—From Trans. of 7th Congress for Inter. Med. Wiesbaden, April 9-12, 1888.

COLLECTING SALT-WATER SPONGES.*—W.B.Hardy gives the following instruction in regard to sponge collecting: The collector should be on the ground an hour before the tide begins to rise, and choose some sheltered nook among the rocks, if the coast be a rocky one, or about the piles of a pier if it be an open one. Here will be found attached to the under surface of inclined stones, and in the clefts of the rocks, on seaweed, and in any sheltered spots where there is good surface for attachment and where the sun does not strike too strongly,—tenacious masses of sponge,—yellow, green, brown, or orange color, and with large orifices on the surface. The most common is of a sponge-yellow color, shading into green on exposed parts. This is the *Halichondria panicea*, or "bread crumb" sponge of Ellis. Another common form, of a salmon color, is *Hymeniacidon sanguinea*. Pieces of the sponge should be removed as carefully as possible and taken home in a considerable quantity of fresh sea water.

For examining the specimen in the study of its anatomy, a pocket lense, a couple of teazing needles, a pipette, and a microscope with a few slips and cover glasses will be required.

EMBEDDING IN PARAFFIN.†—Dr. Geo. A. Piersol says that while the turpentine-paraffin method so commonly employed in histological work yields excellent results, the advantages of chloroform-paraffin has led to its exclusive adoption in the laboratory of the University of Pennsylvania. It is very desirable to secure homogeneity of the paraffin after embedding,—and for this purpose the method of Kölliker is employed. In this the cell containing the object and melted paraffin is surrounded with cold water to the upper surface, which alone is left exposed, being cooled by blowing until a film is formed, when the whole is submerged. The best paraffin is that commercially known as winter-worked gum stock, and comes in cakes about 4 cm. thick; that having a bluish tint, and emitting a metallic ring when struck, is the best.

STAINING THE WALLS OF YEAST-PLANT CELLS.‡—In demonstrating the two membranes of the cell of the yeast-plant, Vines found that by staining the cells first in methyl-violet, washing in distilled water and then transferring to aniline green for some hours, in some instances the inner membrane appears of a violet color, while the inner layer takes a slight green.

* Hardwick's Science Gossip, January, 1889, p. 11.
†University Medical Magazine, December, 1888.
‡Journal of Microscopy, January, 1888, p. 12.

PATHOLOGY.*

THE "WORM" OF THE HUMAN BLOOD.†—In 1866 Wucherer, of Brazil, discovered in chylous urine, and later in the urine of a patient suffering from hæmaturia, several embryos of a nematode,—to which Lewis, of Calcutta, who found the same organism in the blood of a native boy, in 1872 gave the name *Filaria sanguinis hominis.* Cobbold found them in great numbers in the urine of a case of "Bitharzia,"—and in 1874 Sonsiné of Cairo, found the living "worms" in the blood and urine of a boy suffering from hæmaturia. The same nematode has been found in the exudate of "craw-craw"—a skin disease common to South African negroes,—and in various conditions affecting the system. According to Manson the worm has its chosen habitat in the lymphatics, traverses readily the gland tissue until the thoracic duct is reached, when it enters the circulation. His theory is that the larvæ of these parasites are withdrawn from the blood by the mosquito or sand-fly, and by them deposited in water, in which they partially develop, are then drank, still further develop in the stomach, and finally enter the lymphatics, where they attain maturity.

MICROSCOPICAL CHANGES IN PERITONEAL ADHESIONS.‡—Graser finds from his investigations on this subject in animals, that in many cases adhesion takes place direct between the endothelium of the two peritoneal surfaces, without the intervention of other elements, or a layer of fluid between the two. In a second method of adhesion, and the most frequent, the endothelium is destroyed on one or both sides,—the subendothelial layer taking the active part. In a third class, where the peritoneal surfaces are not in apposition, an exudate usually appears between the layers. This consists either of a granular mass of fibrin, or of fibrine containing wandering cells. The endothelium in these cases swells up and finally disappears, or it proliforates, penetrates widely into the exudate, and assumes a cuboidal form. The adhesion is produced by spindle-shaped elements, which penetrate from the surrounding parts, where the space between the layers is considerable, or the exudation is large, and these spindle-cells are not sufficient to unite the two surfaces, adhesion is produced by the formation of new blood-vessels.

* Under this heading will be included all Abstracts relating to the Histology of Diseased Tissues, both Animal and Vegetable.

† Annals of Surgery, 1888.

‡ Fortschritte der Medicine, November 1, 1888.

MISCELLANEOUS.

THE MICROSCOPE AS APPLIED TO FUNGOLOGY.*—Rev. J. E. Vize contibutes an interesting paper on this subject for beginners. Students may be divided into two groups—those who study the larger fungi, and those who investigate the microscopic forms. These latter forms may be examined all the year round,—each separate month may give different developments of one and the same fungus. By this means the life history may be watched and studied, and becomes very absorbing as well as very instructive. The field of investigation for the microscopical student is very much more extensive as to the numbers of plants, than for those who only take the large forms. The increase of new microscopical fungi is immensely greater than for the other kinds, hence new species may be found more frequently. Then, again, as to preservation of species for reference, the small forms are more easily preserved for future reference than the others, whether in the herbarium or as slides, notwithstanding the fact that there are difficulties in both. The herbarium in a place liable to atmospheric changes is sure sooner or later to be attacked with some vegetable growth to damage the specimens—a source of special annoyance with unique plants—or the ravages of insects may reduce the specimens to a powdery dust, and render what formerly was prized, equal in value to nothing.

As to the medium in which these microscopical slides are to be mounted. I have worked at the microscope for thirty-five years, and cannot tell yet, nor do I think the man is born who can tell, which is the best mounting medium. What suits one fungus does not necessarily suit another. Canada balsam contracts the spores and is apt to contort them. Glycerine pure and simple simply refuses in course of time to remain in the cell of the slide, and works its way out. Glycerine jelly is nearly as bad, and, in common with gelatine medium, contracts and expands with the temperature of the weather, and, therefore, is unreliable. Thwaite's fluid, like water, may be very successful for a time, but will be sure to change the color of the tissue eventually. Camphor water, and the other media which have been used in the vain attempt of beautifully balancing themselves, so as to check either the growth or decay of the plant, all fail. If anyone asks me what media I should now use, and recommend others to use, my answer would be—for any fungi that would bear them (and they are not numerous) employ Canada balsam. First take

* Provincial Medical Journal, November, 1888.

the greatest possible care to keep the spores in their natural place by giving them as small a quantity, not of pure spirits of wine, which scatters them, but benzole, which has a different effect. Let the benzole evaporate, then mount. When Canada balsam will not suit, as is generally the case, I use gelatine, warming all the materials used. Water I may say is, to the best of my knowledge, indispensable when you want to see such portions of a fungus as the zoospores. Much advantage may be gained by putting on the label of the slide not only the name of the object but the medium in which the same is mounted. I have slides in my cabinet of great scarcity, which it would be next to impossible to replace. Some of them have lost the whole of the medium in which they are placed through evaporation, and are almost valueless. Others have not gone so badly, but there are large bubbles of air in them, which are the forerunners of total evaporation. Had the original mounter of the same named the fluid in which they were placed on the slide, there would have been little difficulty in bringing them back to their primitive condition.

DANGER IN THE POSTAGE STAMP.—The *Sanitary News* calls attention to the fact that a postage stamp may in various ways convey contagion. One of the simplest and most plausible, is that in which a postage stamp, partly attached to a letter to pay return postage, is sent by a person infected with some disease to another person. The disease is transferred in the first place to the adhesive stamp through the saliva, and in being attached to the letter by the receiver the poison may be transmitted to him in turn through the saliva. Another cause may be the infection of the stamp with disease germs. That this is true can be proven very simply by a microscopical examination.

We often see persons holding change for a moment in the mouth, probably not knowing that investigation has shown that disease germs can be carried by money. If they could see through what hands the money has passed, they would hesitate before using such a third hand. Silver money is as bad as paper money, but while many would hesitate to hold a dirty bank note in the mouth, they think that a silver piece, because bright, is apparently clean.—*Medical News.*

USES OF PHOTOMICOGRAPHY.*—Bastelberger's paper before the Society of German Naturalists and Physicians dealt with the uses of photomicrography, in which the author favored the wet-plate process. This is of great service in permanently fixing the pictures of rapidly

* Neural. Centralblatt, October 1, 1888.

perishing preparations, and in making exact measurements, for which the micrometer scale should be photographed with the object. He thought that by means of photography a greater morphological difference in the structure of the central nervous organs, which now appear to be homogeneous, might be discovered. Photography might also be used for deciphering places in old manuscripts which had become too pale to be distinguished by the human eye, the invisible ultra violet rays of which would strongly affect the photographic plate.

NEWS AND NOTES.

ACCORDING to M. Fremont, the difference in properties of the Vichy spring waters is due to the various microbes contained therein.

THE Botanical Society of Western Pennsylvania numbers 55 members. Among the names, we recognize those of several well-known microscopists.

MISS M. A. BOOTH recommends, in the *Pharmaceutical Era*, a thick solution of dextrine in water to which a few drops of glycerin has been added, as a superior solution for securing labels to slides.

As a substitute for corks in imbedding, Dr. Freeborn recommends "deck-plugs," which are cylinders of white pine, to be obtained of manufacturers of barrel bungs, and vary in diameter from half an inch to one and one-half inches. Not only are they not made soft and yielding by soaking in dilute alcohol, but they may be written upon with lead pencil, thus enabling the microscopist to keep several specimens in the same bottle of alcohol.—*Pharmaceutical Era.*

THE Pittsburgh *Dispatch* of February 7th chronicles the return of the astronomer, Prof. John A. Brashear, from his trip to the Pacific coast, whither he went in December to make observations of the recent solar eclipse. Mr. Brashear tells the experience of his trip in a pleasant narrative of a column and a half.

BOOK REVIEWS.

THREE KINGDOMS. A handbook of the Agassiz Association, by Harlan H. Ballard, President of the Association. New York: The Writers' Publishing Co. Pp. 167

The fact that this hand-book is already in its seventh thousand is recommendation enough. Besides the matter of particular value

to members of the association, there is much in Mr. Ballard's book of interest to the general reader,—and we know of no better guide for the beginner in any department of natural history. The book does not teach, but it points out the way and the literature of the subject. An excellent portrait of Prof. Agassiz is the frontispiece.

ANIMAL PHYSIOLOGY. By Wm. S. Furneaux. Longmans, Green & Co., London and New York.

A bright little book, both outside and in. Old truths in new lights are so arranged that the matter reads like a story. The work is profusely illustrated and makes a good hand-book for elementary schools.

THE DETROIT JOURNAL YEAR BOOK FOR 1889. Pp. 117, Paper. 25 cents. By mail, 30 cents.

This little book contains a vast amount of information on all sorts of subjects. The facts which every one forgets, but frequently desires to know, are collected and tabulated for ready reference. It is one of the best of its class.

BRIGHT'S DISEASE. By Alfred L. Loomis, M. D. Physician's Leisure Library. Paper. Pp. 112. Price, 25 cents. Geo. S. Davis, Detroit.

To those acquainted with Dr. Loomis' writings, we need not say that this volume contains a full and modern exposition of the subject. It discusses not only Bright's disease proper, but many other pathological conditions of the kidney. The lines on treatment are especially valuable and deserve careful reading.

DISEASES OF THE KIDNEYS. By Dujardin Beaumetz, M. D. Physicians' Leisure Library. Paper. Pp. 161. Price 25 cents. Geo. S. Davis, Detroit.

This is another of Dr. Hurd's excellent translations of Beaumetz' works. Though not exhaustive in its treatment of the subject, it contains much that is new to our therapeutics of the diseases of the kidney.

ON THE MICROSCOPICAL EXAMINATION OF URINARY SEDIMENT. By William B. Canfield, A. M., M. D. Reprint.

THE GONOCOCCUS. William Buckingham Canfield, A. M., M. D. Reprint.

REPORT OF THE COMMITTEE ON OPHTHALMOLOGY AND OTOLOGY. By Seth S. Bishop, M. D. Reprint.

A NEW ADJUSTABLE GAS BRACKET. By Seth S. Bishop, M. D. Reprint.

REPORT OF THE COMMITTEE ON THE POLLUTION OF WATER SUPPLIES. Am. Public Health Assn. Reprint.

MICHIGAN STATE BOARD OF HEALTH. Pamphlets.

SPEECH OF HON. WM. M. STEWART OF NEVADA, delivered in the Senate of the U. S., January 2, 1889.

MESSAGE OF GOV. ROBERT L. TAYLOR to the 46th General Assembly of the State of Tennessee, January 10, 1889.

CORRESPONDENCE AND QUERIES.

CORRESPONDENTS IN ANSWERING QUERIES WILL PLEASE REFER TO NUMBERS ONLY.

BRISTOL, CONN., Jan'y 1st, 1889.

Editors Microscope:

I have been much interested in the article in your January number on cleaning diatoms by F. W. Weir.

He says that the process given "is more satisfactory than any *published method* with which he is familiar." I would call his attention to an article published in the April, 1887, number of the *American Microscopical Journal*, in which the so-called "cold process" is given in minute detail.

I had invented and used the process with great satisfaction for some time, and finding, by correspondence with many of the principal professionals and experts, that such process was needed, I published it as *original* in the above mentioned journal.

The shaking and sanding process had been previously published in the same journal by Dr. Geo. H. Taylor of Mobile, Ala., but he subsequently announced that he had found the shaking destructive.

I would remark that if material containing the larger Pleurosigma, for instance, were subjected to the shaking described by Mr. Weir, not one in a hundred of these forms would remain unbroken, and the method described would be nearly as destructive to many of the larger or longer fresh-water varieties.

Yours truly, WM. A. TERRY.

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14. If I remember rightly, the poplein deposit of Calvert Co. Md., was first brought to notice by an attempted fraud to place it upon the market as a fertilizer, the markings of the guard cells of the silicious cuticles of the gramineæ being adduced to show that the silicious forms found in this earth are necessary to plant nutrition. The fraud was exposed by the Agricultural Department. Will some one kindly refer me to the volume of the Agricultural Reports where this account is given?

M. B.

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15. THE USE OF DIAPHRAGMS.—I would like to hear an expression from your readers in regard to the use of diaphragms. Some microscopists claim that they are useless, while others will not work without this accessory. I understand that no diaphragm is supplied with the Griffith Club Microscope, unless especially ordered.

H. M. W.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS *who have microscopical apparatus, material or books which they wish to exchange, and such wants will be* INSERTED FREE OF CHARGE. *The number of insertions given will depend upon the number of exchanges received each month. Subscribers will please notify us when articles have been exchanged or sold. Dealers are referred to our advertising department.*

EXCHANGE—Good mounts of animal tissues, human and other, in health and disease, which I offer in exchange for books on microscopy, histology, pathology and bacteriology. Correspondence invited. E. D. BONDURANT, Tuskaloosa, Ala.

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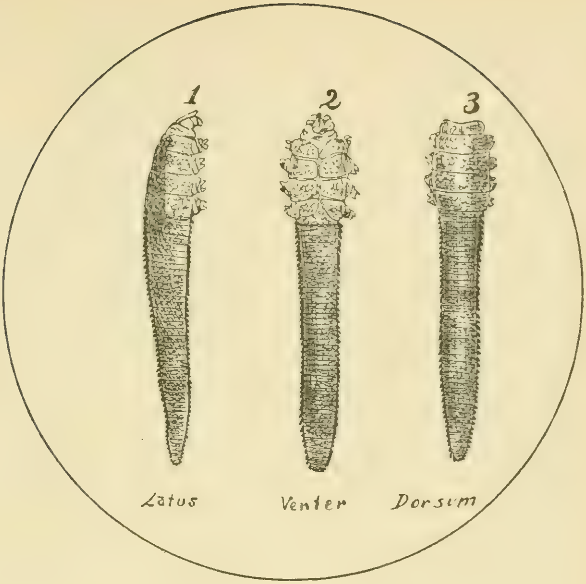

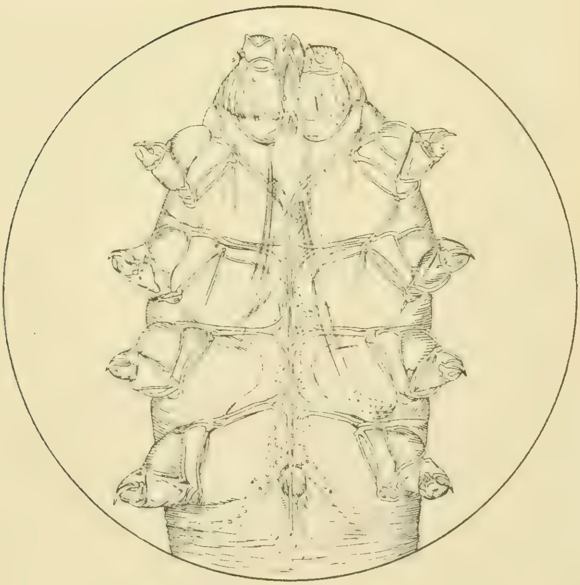

PLATE IV.

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ORIGINAL COMMUNICATIONS.

THE *ACARUS FOLLICULORUM* IN THE HUMAN SKIN.*

CHEVALIER Q. JACKSON, M. D.

[PLATE IV.]

COBBOLD, in the introduction to his admirable, though contracted work on Entozoa, writes :

"Whatever notions people may entertain respecting the dignity of the human race, there is no gainsaying the fact that we share with the lower animals the rather humiliating privilege and prerogative of entertaining a great variety of parasites."

Now prominent among these parasites is the *Acarus folliculorum*, or as it is more commonly, though less advisedly, called, *Demodex folliculorum.* And since probably two-thirds of the members of this society have each some thousands, more or less, of these parasites in the sebaceous follicles of their skins, a few remarks on the mite may not prove uninteresting.

In 1841, Henle described this little octozoon in the secretion commonly known as "ear-wax," of the external auditory meatus. Independently of this, in 1842, Dr. Simon, a German physician announced in the June number of Müller's Archiv, his discovery of *Demodex folliculorum* in the unctuous plug of hardened secretion which, under the ordinary local conditions, occupies the ducts of the oil-glands of the skin. In the latter part of the same year, Wilson, the father of dermatology, communicated to the Royal Society the

* Read before the Iron City Microscopical Society, January 8, 1889.

results of an extended series of investigations, by which many points n the anatomy and life-history of this parasite (which he called "*Entozoon folliculorum*") were for the first time clearly demonstrated. Since then numerous investigators and naturalists, notably Mégnin and Gruby, have added largely to our knowledge of the morphology of the animal.

The *Acarus folliculorum*, *Demodex folliculorum*, or *Steatozoon folliculorum*, as it has been variously called, is an ecto-parasitic mite belonging to the family *Tanurides*, of which it is the type, of the order *Acaridea*, of which it is one of the lowest forms.

I have here some photographs showing the animal in different positions, taken from Wilson's work on "Healthy Skin and Hair": and also a photograph showing the cephalo-thorax of the parasite, taken from a steel-plate kindly loaned me by vice-president C. C. Mellor. This plate makes the finest picture of the portion of the mite it represents, that I have ever seen, and is, I am sure, the best ever made of this or any other animal of its kind. The photographs were made for me by our fellow-member, Mr. W. S. Bell, and very accurately represent the *Acarus*.

Under my microscope I have a slide prepared in glycerine, showing a specimen of *Demodex folliculorum*, taken from the skin of the nose of a young lady of this city.

Looked at individually, *Acarus folliculorum* is a well proportioned, symetrical little animal, of an average length of about one one-hundredth of an inch. The anterior one-third of his length consists of a cephalo-thorax, along the sides of which are ranged, in the mature individual, four pairs of rather rudimentary legs. Like some other acaridea, the immature animal has but three pairs of locomotor organs. Two movable organs, probably palpi, are set in the anterior extremity of the cephalo-thorax. To the posterior extremity of the cephalo-thorax, which varies but little in length, is joined a long, tail-like body which varies very greatly in length. The integument is soft, transparent, and striated circumferentially.

The animal is oviparous: the egg being of a relatively large size.

Let us look for a moment at the habitat of *Acarus folliculorum*. This parasite is found in the unctuous plug of hardened secretion which occupies the ducts of the subaceous folicles of the skin. This cheesy plug, which forms the nidus and furnishes the pabulum for the little fellow, is produced by a dilation of the follicles, resulting from a sluggish, ill-functionating condition of the skin, present, to a

greater or lesser extent, in almost every one. This condition of torpidity produces an abnormal consistency of the secretion, on account of which the products of the gland-cells accumulate in the duct as a hard plug, instead of escaping at the free extremity of the tube, or pore, as an oil for the proper lubrication of the skin. Dirt accumulates in the exposed extremity of the plug, and then we have a comedone, or as it is commonly called, a blackhead. Such is the habitat of this parasite. In this constantly warm and comfortable nidus the acari breed and proliferate, though not with startling rapidity. A rather remarkable fact is that both old and young acari constantly maintain the same relation to the follicle. That is, the axes of their bodies are always nearly parallel with the axis of the duct of the oil-gland, the tail almost invariably pointing outward, and the head directed inward toward the floor of the follicle, as if the animal had crawled into his position from without. To use a nautical term, they always lie "head on."

Sometimes ladies whom I am treating for cosmetic troubles, will ask me for some medication to remove the "worms" (!) from their faces, under the impression that the comedone, or blackhead, is alive! This impression is partly due to the appearance of the unctuous plug when squeezed out, and partially also to the advertisements of quacks, who make capital out of the proven presence of the innocent little *Demodex*, and blame him with causing the very trouble which he is doing his best to relieve.

The number of acari present in a single follicle varies from one to twenty, there being much diversity of numbers according to the age and condition of health of the host, and also according to the location of the follicle. Though they are to be found in the skin of persons of any age, sex or condition of health, yet local and general ill-health and the waning powers of old age, seem to be the conditions most suitable to the entertainment and proliferation of the parasite. Notwithstanding this, the *Acarus folliculorum* is to be found in persons entirely healthy in every respect, unless, indeed, dilatation of the follicles be considered a diseased state of the skin. But since everyone living in cities, at least, has this dilated condition, the presence of the parasite may be considered the rule, and its absence the exception. Gruby found acari in forty out of sixty persons, or $66\frac{2}{3}$ per cent. Wilson found a larger percentage. Some naturalists, as Megnin, have only found the parasite present in ten per cent. I myself have, within the past two years, examined comedones from one hundred persons, chiefly ladies, in this city, and

found the acari in seventy-two out of the hundred, or 72 per cent. This, however, is probably a rather large percentage, and does not represent quite an average of healthy persons, as most all of them were under treatment for cosmetic troubles. While connected with the Philadelphia Hospital for Skin Diseases, some years ago, I examined comedones from one hundred and fifty persons, with the result of finding the acari present in 76 per cent. But the entire one hundred and fifty were suffering either from acne, commonly known as "pimples," or comedones, popularly called "blackheads," or some other disease due to a local ill function of the skin. Now while *Acarus folliculorum*, unlike his fellow acarus, *Sarcoptis scabiei*, does not appear to have any causative relation to any form of disease of the skin, yet it is only present when the dilatation of the duct wall is marked. They tend rather to decrease than to cause the trouble, by eating up and disintegrating the plug of hardened secretion.

As regards the location of the infested follicle, the greatest number, as well as the largest, longest, and healthiest looking specimens of *Acari folliculorum*, are to be found in the follicles of the skin in the region of the alæ nasi; while the shorter, smaller, more dried-up looking individuals infest the skin of the nasal and superciliary ridges of the human face, and some few are present in the follicles of other portions of the body. The reason for this variation in the size and distribution of the *Demodex folliculorum* is the relative variation in the lumen of the duct, and the diversity of density and nutritive quality of the plug occupying the ducts of the respective glands.

The *Acarus folliculorum* is also found between the hair-cylinder and internal root-sheath of the hair-follicles, from which circumstance it has been called the "hair-sac mite." These acari are also found in animals other than man: the dog, wolf, and horse being infested. I myself have found it in the cow, in whom it is relatively more tapering and slender, though larger, than in man.

With regard to the preparation of this mite for the microscope, the mode of procedure is to squeeze the plug of secretion from its position in the face. Then teaze out the mass in glycerine, cover with a cover-glass and place under pressure till all the air is expelled, when it is ready for examination. When found, if still clinging to a portion of sebaceous matter, the cover-glass may be gently moved to and fro with a handled needle, while keeping the animal in view under a low power, until it is floating free in the glycerine, when it can be examined, turned over and manipulated. Or it may be isolated from the debris, and permanently mounted.

Fig. I.

Fig. II.

Fig. III.

PLATE V.

He is somewhat difficult to find, this little *Demodex*, owing to his great transparency, and a very careful search will often be necessary to discover him.

I purpose, at some future meeting of this society, presenting some slides of this ectozoon as seen in various animals, with a more detailed description of the structure and organization of the parasite, of which it may truthfully be said to two-thirds of mankind: "Like the poor, 'ye have them always with you.'"

PITTSBURGH, PA.

THE ORIGIN AND DEVELOPMENT OF THE FAT CELL OF THE FROG. (*RANA HALECINA.*)

W. C. BORDEN, M. D., U. S. ARMY.

[PLATE V.]

IN VIEW of the diversity of opinion which obtains in regard to the origin of the fat cell, it has seemed to me that a record of observations made by myself upon the origin and mode of development of the fat cell of the common marsh or leopard frog (*Rana halecina*), would be of interest. In certain of the lower vertebrata, of which the frog is one, the adipose tissue, instead of being scattered through the body without regard to particular place, is found in certain definite localities only: being there accumulated into what are known as *fat bodies*, or *corpora adiposa*. The corpora adiposa of the marsh frog are two in number, and are situated at the dorsal side of the abdominal cavity in close relation with the kidneys and testes in the male, and the ovaries in the female.

They are attached to the generative organs by bands of connective tissue, and like them receive their arterial supply through several small branches of the dorsal aorta. Their veins are branches of the inferior vena cava. Each fat body consists of a main portion and several processes: and might be compared in form to the human hand, with its fingers increased in number and greatly elongated. They vary greatly in size in different individuals, and in the same individual at different seasons of the year. During the summer they are large and fully developed, nearly every cell being distended with fat.

A microscopical examination made at this time gives only the usual appearance of fully formed fat tissue. In the early spring, however, the fat bodies are smaller and most of the cells are undergoing development, and it is at this season of the year, that on microscopical examination will be found all the phases of development, from the undifferentiated cell, to the fully-formed fat cell, with its

peripherally situated nucleus and body distended with fat. In a cross section of one of the processes of a fat body taken from a frog in the early spring, the special plasma cells, from which the fat cells are to be formed, together with the partially formed cells, are found in greatest number at and near the periphery of the section; the more mature cells, whose bodies are filled with fat, occupying mainly the central portion.

The special plasma cells (primordial fat cells) bear no resemblance (other than a general one) to connective tissue cells, and there is no evidence, to be adduced from observations on the cells of the fat bodies of the frog, tending to show that the fat cells of these bodies ever arise from the cells of connective tissue.

On the contrary, it is seen that the cell ordinarily known as the fat cell is but the secondary and mature form of a special cell. This special cell in its primary form is oblong in shape, with a distinct nucleus and intra-nuclear reticulum well marked. (Fig 2.)

This reticulum has the form of the rosette in karyokinesis, but whether or not it is a step in this process I cannot positively say, as I have been unable to make out other karyokinetic figures either preceding or following this one. That it is one of the phases of karyokinesis is rendered very probable by the nuclear division which follows; and it is doubtless owing only to insufficient refinement of technique that the entire process has not been observed. However, this is, as regards the purpose of this article, of secondary importance, as it is the peculiar change undergone by the cell and its nucleus, during the passage of the cell into its second stage, to which I particularly desire to call attention.

This change, of which the formation and deposit of fat is a part, differs markedly from anything I have myself observed in other animals, or seen recorded as occurring during the development of the adipose cell in them. The fat cell is described by various observers as developing either from a connective tissue cell,* or from a special plasma cell,† or from either,‡ by the formation of minute drops of fat in the body of the cell, the drops increasing in size and coalescing into one, which continuing to grow, distends the cell until it is but a protoplasmic envelope of the contained fat.

* The authorities who hold the connective tissue origin of fat cells are: Quain, Frey, Virchow, Klein, Klein and Smith, Flemming, Von Wittich, Prudden.

† The supporters of the special plasma cell origin of the fat cell are: Ranvier, Hoggan, Rollett, Czajewicz.

‡ Professor Gage from observations on the Necturus, concludes that the fat cell may arise from either connective tissue, or special plasma cells. See his article: "Observations on the Fat Cells and Connective Tissue Corpuscles of Necturus (Menobranchus)" "Proceedings of the American Society of Microscopists," 1882. Elmira Meeting; which also contains an extensive bibliography.

Leaving out the question of origin there is, from numerous recorded observations, no doubt that the above is the method of development of the fat cell in the higher vertebrata. In my observations on the method of development of the fat cell of the frog, on the contrary, I have never seen the fat first appear in the above described manner. The fat is deposited in a single drop only, and the first appearance of fat in the cell is synchronous with *nuclear division.*

Activity of the cell nucleus has never been described, so far as I am aware as part of the process of cell development in the fat cell, the nucleus being only spoken of as passively displaced and crowded to the side of the cell by the accumulating fat.

In contrast with this, my observations on the development of the fat cell of the frog show that, next to the formation of fat, activity of the cell nucleus is the most striking feature in the process, and that the change undergone by the nucleus during the development of the cell is both important and interesting.

As the first step in development, the nucleus of the special plasma cell widens laterally and the intra-nuclear reticulum separates into two, forming an intra-nuclear line, along which the nucleus afterward divides. (Fig. 1. AA.)

Immediately after the formation of the intra-nuclear line, and while the nucleus not yet separated into two, has the appearance of two nuclei in close apposition, a minute droplet of fat is formed and deposited in the cell body at one end of the line. This accumulation of fat grows in size, and the nucleus divides along the intranuclear line, the division beginning at the end of the line next the fat. The fat follows into the space so formed like a wedge, separating the two portions of the nucleus. (Fig. 1, B. C. Fig. 3, F.) This process continues and completes the division of the nucleus. (Fig. 1, D. D.) As the cell still continues to form and deposit fat in its interior, the separated nuclei are pushed further and further apart, and become more flattened in shape, as if by pressure from the accumulating fat, the intra-nuclear reticulum progressively becoming more and more indistinct. (Fig. 1, F. H.)

The fully matured fat cell has the usual form of the fat cell, a very thin protoplasmic covering, enclosing a large drop of fat. There are, however, two flattened and peripherically placed nuclei instead of one. It is difficult, however, in examining sections of a fat body taken in the summer from a well nourished frog, when all the cells are developed, to satisfactorily demonstrate that each cell has two nuclei, the cells being so fully distended with contained fat, and so crowded together as to make the exact relation of each

nucleus to its own cell very difficult to make out. The fact that each cell has two nuclei would probably be overlooked, were it not that the developing cell shows them so plainly.

From the foregoing description of the origin and method of development of the fat cell of the frog, it seems admissible to formulate the following :

I. That, in the frog, the fat cell is derived from a special plasma cell by a peculiar method of development.

II. That, as the mode of development of the fat cell of the frog differs from that described for certain other animals, the process of development of the fat cell is not the same in all animals.

III. That, the development of the fat cell of the frog from a special plasma cell, and the aggregation of these cells in a particular locality (organ, corpora adiposa), for a special function, (making, storing and supplying fat), shows that the fat cell of this animal is a *fully differentiated* cell, having nothing in origin or function in common with connective tissue.

Methods of Investigation.—For studying the development of the fat cells, the fat bodies taken from a frog killed in the early spring should be used. Careful disassociation with needles in normal salt solution, and subsequent staining with picro-carmine is useful. It is best, before preparing a body for sectioning, to examine a portion of the adjacent one in the manner above mentioned, in order to ascertain if it is in suitable condition. If it is found that all the cells are full of fat, another frog should be tried.

Hardening with one of the osmic acid fluids, and subsequent staining with carmine, gives excellent results, particularly in demonstrating the fat, as it is blackened by the acid.

In staining with borax-carmine care must be used not to remove too much of the color with acid, or the cell body will be rendered indistinct.

I have obtained the best results, and sharpest pictures of the cells in all stages of development, by hardening the corpora adiposa in Müller's fluid and alcohol, staining in bulk in alum carmine fluid,* and interstitially imbedding in paraffin. With a sledge microtome a great many sections may be cut from a single body so treated, each one of which will show a great number of cells in different phases of development.

* "THE MICROSCOPE," March, 1888, page 83. "An Alcoholic Alum Carmine Stain."

DESCRIPTION OF FIGURES.

Fig. 1. From the fat body of a frog near the periphery of a cross section of one of the processes. Drawn with camera lucida. B, V, blood vessels. The nuclei of the endothelial cells and the contained blood corpuscles are shown. A, A, special plasma cells in which the intra-nuclear line has formed. B, cell in which the deposit of fat is recent. C, C, D, E, F, H, cells showing progressive accumulation of fat, with division of the nucleus.

Fig. 2. Special plasma cell before the appearance of the intra-nuclear line.

Fig. 3. Cell showing the nucleus being divided along intra-nuclear line. The fat (F) following like a wedge into the space so formed.

THE DIATOMS OF MOBILE, ALABAMA.

K. M. CUNNINGHAM.

IN TWO previous articles which appeared in this Journal, I communicated on methods of collecting and cleaning diatoms, and the manner of selecting and arranging the same. In this article it is proposed to give the result of pursuing the instructions therein given, by referring to a type-plate of the diatoms of Mobile, and immediate neighborhood, which was made by me in the month of September, 1888, with the object of permanently placing on record the desultory and prolonged study of the diatoms of the above named region, covering a period of ten years. Circumstances, however, prevented the final result from being as comprehensive as it should have been; nevertheless, what has been accomplished has some merit in itself, and is capable of interesting those who have been, and are now interested in those beautiful unicellular algæ, the Diatomaceæ.

The type-slide referred to, contains closely aggregated in a small parallelogram, of about one-tenth of an inch in width, by four-tenths in length, nearly 1,500 selected diatoms, representing about ninety distinct species, of which a list of the species, as determined by the Hon. J. D. Cox, is appended to this article. The type-slide was, furthermore, by voluntary request, sent to Dr. D. B. Ward of Poughkeepsie, who microphotographed it in five sections, thus enabling the preparation to be afterwards reproduced as a whole, by the portrait camera, of such a magnitude as to be satisfactorily inspected by the eye, unaided by other optical means. To prepare the slide, it became necessary to clean up samples of diatom-bearing material from twenty localities, comprising salt, lake,

spring, creek, river, and swamp waters, and water-plant sources; these were alternately cleaned and spread upon slides, and therefrom its quota of leading species were selected by the aid of a very fine bristle, and transferred to separate bits of thin cover-glass. When all the material available at the time had been thus gone over, a thin cover-glass was selected and upon this all of the selected forms were transferred by the methods and means described in the article on arranging diatoms. It can be readily surmised, that in the pursuance of this work, many features connected with the structure and colors of particular diatoms would be observed ; for example, the fragile nature of many of the discs, the hoop, or connecting band, easily separating from its disc-like sides; many of the navicular forms separating in like manner ; the flexible, or elastic nature of the nitzschias ; many of the discs which show beautiful tints when in balsam, merely appearing of an amber brown while dry; also, may be noted the wide variation in size, in diameter, or otherwise, of the same species ; as well as the variety in contour, or outline, of similar species ; which facts impress themselves upon the mind with more effect than when an ordinary spread slide is being passed under observation. I hope to be able at some future time to review all of the strewn and type-plate preparations which I, and others, have prepared, and which I hold, of Mobile, Ala., diatoms and have them identified and listed, so as to carry the list of species noted to the highest figure yet reached for this epoch. As numerous familiar species were not available in the crude state, when the present type-slide was being prepared, they will therefore not be alluded to in this article. Since I undertook to make the above initial type-plate I have found that the method is rapidly applicable to the analysis of all diatom-bearing material, as within an interval of an hour or two at most, a representative slide of a hundred or more of the various contained species in a given material may be prepared, suitable to the most fastidious inspection ; by adopting the system of freehand selecting, the slow system of referring to species in strewn mounts by the record indices of the Maltwood finder, would be largely dispensed with, and other advantages become manifest after a little reflection. As an illustration of the ease and quickness of the selecting methods previously published, and followed out by myself, I may state that I have presented to interested parties seven selected slides of different fossil earths, no preparation containing less than fifty diatoms, or foraminifera, the limit being about one hundred. I would, however, not pretend that they were prepared in the highest perfection of the art.

The following list of species, identified through the kindness of

Hon. J. D. Cox, were noted as occurring among the many forms on the selected slide, and may be regarded as representing the major number of species (excluding the marine forms) which can be found at Mobile, Ala., outside of an extensive study and search.

Actinocyclus Ehrenbergii.
Antinoptychus splendens.
Do. undulatus.
Amphiprora elegans.
Do. vitrea.
Amphora proteus.
Do. Donkinii.
Auliscus confluens.
Do. pruinosus.
Do. do. var. apiculata.
Do. punctatus.
Do. do. var. stigmosa.
Do. radiatus.
Biddulphia aurita.
Do. Baileyi.
Do. lævis.
Do. rhombus.
Do. Tuomeyi.
Campylodiscus cribrosus.
Do. echineis.
Do. limbatus.
Cerataulus turgidus.
Cocconeis pediculus.
Coscinodiscus excentricus.
Do. radiatus.
Do. subtilis.
Cymbella cistula.
Dimeragramma marinum.
Epithemia zebra.
Do. turgida.
Do. gibba.
Eunotia arcus.
Do. diodon.
Do. diadema.
Do. triodon.
Eupodiscus argus.
Do. Rogersii.

Navicula Lyra, type.
Do. do. var. recta.
Do. do. do. elliptica.
Do. do. do. dilatata.
Do. cuspidata.
Do. firma.
Do. elliptica.
Do. firma, var. dilatata.
Do. do. do. affinis.
Do. maculata.
Do. rhomboides.
Do. interrupta.
Do. permagna.
Do. gomphonemacea.
Do. peregrina.
Do. major.
Do. nobilis.
Do. rostella.
Nitzschia circumsuta.
Do. sigma, var. elongata.
Do. sigmoidea.
Do. scalaris.
Do. dubia.
Melosira punctata.
Do. Borrerii.
Mastogloia angulata.
Orthosira marina.
Pleurosigma angulatum.
Do. aestuarii.
Do. balticum.
Do. decorum.
Do. formosum.
Rhabdonema arcuatum.
Surirella splendida.
Do. nobilis.
Do. fastuosa.
Do. ovata.

Eupodiscus radiatus.
Navicula Americana.
Do. clavata.
Do. Hennedyi.
Do. liber.
Do. irrorata.
Do. insignis.
Do. crabro.
Do. Smithii.
Stauroneis gracilis.
Do. phœnicentron.
Do. pulchella.
Synedra radians.
Terpsinœ musica.
Do. Americana.
Tryblionella marginata.
Triceratium favus.
Do. trydactylum.

To the foregoing list I will add the following species, included in a list heretofore published by the Hon. J. D. Cox, as appearing upon his type-plate of Mobile Diatoms, none of which are found in my type-plate, but which are mostly preserved in strewn slides or type-plates in my possession.

Actinocyclus fuscus.
Actinoptychus areolatus.
Do. tri. fol., McNeill.
Amphiprora alata.
Do. costata, N. Sp., J. D. C.
Do. lepidoptera.
Amphora Cleveii.
Do. singulata.
Do. obtusa.
Amphitetras antidiluviana.
Asteromphalus Brookii.
Anliscus coelatus.
Bacteriastrum curvatum.
Campylodiscus ecclesianus.
Do. Samoensis.
Cerataulus Smithii.
Coscinodiscus lineatus.
Do. nitidus.
Cymatopleura elliptica.
Cymbella heteropleura.
Do. lanceolatum.
Eunotia parallela.
Grammatophora marina.
Navicula Braziliensis.
Do. Carribbea.
Do. didyma.
Do. Jamaicensis.
Do. Lewisiana.
Do. humerosa.
Do. marginata.
Do. sculpta.
Do. serratula.
Do. longa.
Do. distans.
Plagiogramma validum.
Do. Gregorianum.
Pleurosigma acuminatum.
Podosira maculata.
Raphoneis amphiceros.
Surirella Davidsonii.
Do. Febigerii.
Systephania diadema.
Tryblionella punctata.
Triceratium alternans.
Do. sculptum.

Total number of species, including varietal forms named in this article, is 137, and representing 37 genera of the Diatomaceæ.

MOBILE, ALA.

LOGWOOD STAINING SOLUTION.

HENEAGE GIBBES, M. D.,

PROFESSOR OF PATHOLOGY IN THE UNIVERSITY OF MICHIGAN.

LOGWOOD stain has been made in various ways, both from the extract and from the coloring matter Hæmatoxylin, but there has always been a difficulty in keeping the solution at the same strength. The coloring matter deposits on the side of the bottle, and after a time the stain is useless. Another drawback I have found in the different action of various extracts, presumably from some adulteration they contain.

The logwood solution I used for years was made from extract, with three times the amount of alum added. With some extracts this solution was ready for use in three weeks; with others, not for three months. As I had to prepare this stain for the use of large classes, it was often a serious matter having to wait so long, and after trying every extract in the market and finding they all had the same defects in varying degrees, I commenced a series of experiments with logwood chips, with the result that I have found in the following formula all that could be desired in a Logwood Stain.

I find the best chips to use are those having a tawny color and not too small.

Take of

Logwood Chips...........................	1 lb.
Distilled Water............................	50 oz.

Mix in porcelain lined saucepan or granite iron kettle and heat slowly to the boiling point.

Boil for ten minutes, and while boiling stir with a glass rod and add very slowly from ½ to 1 oz. of potash alum.

The addition of the alum instantly turns the color almost black and only sufficient alum is required to do this. The amount varies with different samples of chips.

After the alum is added and the mixture has boiled for ten minutes set it aside for twenty-four hours.

Then filter and add four ounces of alcohol to make it keep.

If properly made it will be ready for use at once.

This Logwood Staining Solution has the following characters to recommend it:

It is inexpensive.

It is easily made.

It is ready for use at once.

It will not deposit on the sides of the bottle.

ANN ARBOR.

PROCEEDINGS OF SOCIETIES.

THE CALCUTTA (INDIA) MICROSCOPICAL SOCIETY.

THIS flourishing society held its first annual meeting in the Asiatic Society's rooms, Calcutta, January 28, 1889. The president, Dr. Simpson, in the chair. The report of the Hon. Secretary showed that the society had grown, during the eighteen months of its existence, from a membership of 20 to 64; that a small library of standard works on microscopy had been begun, and a number of scientific journals subscribed to; that a "postal" branch for the benefit of non-resident members had been started: and that the cabinet now contained about 130 slides: that papers presented at the meetings had been of interest and value.

The following officers were elected for the ensuing year: President, Mr. Woode-Mason; Vice-President, Mr. B. J. Jones; Honorary Secretary, Mr. W. J. Simpson. Council: Messrs. Henderson, W. H. Mills, W. M. Armond and W. H. Ryland.

This society is the first of its kind established east of the Suez Canal: and the success which has been attained during its early existence was predicted in THE MICROSCOPE at the time of its inauguration. The report of the society is embodied in a neat pamphlet.

MICROSCOPICAL SECTION BROOKLYN INSTITUTE.

AT A meeting of the Microscopical Section of the Brooklyn Institute, held February 4th, 1889, a practical demonstration of a method of making balsam mounts in cells, was made by Mr. H. S. Wordman.

The demonstrator remarked that he had tried certain rings and wax cells for balsam mounts and failed to get satisfactory results. His attention had been called to *paper* by an article of Prof. H. L. Smith, who used thin paper for making dry diatom mounts. He tried the ordinary single thick cardboard for a cell of moderate thickness, for such an object as a bee sting, or the object to be mounted on this occasion—a spider spinarette. After five years' use this material has been found very satisfactory.

Some cardboard cells were shown, and the implements used to make them.

The face plate of a small lathe has attached to it a piece of pine wood, and to this is fastened by two screws, a thin piece of iron, with a hole of about 1¼ inch diameter in the center—known to hard-

ware dealers as a washer. About a dozen thicknesses of cardboard, $1\frac{1}{4}$ inches square, are put between the iron and wood, and held tightly by the two screws.

The face plate is rapidly revolved, and with a thin knife, especially made for the purpose, a disc is cut from the center of the cardboard, and then cells for $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$ and $\frac{7}{8}$ inch covers cut, consecutively, the outside circle of $\frac{1}{2}$ inch being the inside of the $\frac{5}{8}$ inch—a dozen of each size are thus cut off at one operation.

When ready to mount select a cell of necessary size, put slide on turn table, and revolving the table, spread with the glass rod some benzole balsam in a circle somewhat larger than the outside diameter of the cell to be used. If balsam is thin the cell becomes readily saturated and drops, or can be pressed down to contact with the slide.

Place object in position, and fill cell rounding full with balsam, and carefully cover. There should be balsam enough outside the cell to fill up the space to a true level, and this balsam can be turned up to a true circle with a knife blade and leave little or no cleaning to be done.

After a few days for hardening, cover with Brown's Rubber Cement. To many this makes the most desirable finish, but after a time other cements can be added according to taste.

IRON CITY MICROSCOPICAL SOCIETY.

THE most interesting exhibit at the last meeting of this society, held February 12, was a slide prepared by Professor Webb, of the University of Pennsylvania, and exhibited by Mr. C. G. Milnor, with a $\frac{1}{10}$ objective and C eye-piece. Dr. Webb had been called in consultation on a case which had puzzled many physicians in Philadelphia. The case was that of a young lady, 19 years old, who in September last complained of not feeling well; the appetite and sleep were fair, and the lungs clear, making it a difficult case to diagnose. Finally Dr. Webb noticed a slight cough, which was so slight that under ordinary circumstances it would not have been noticed. He took some of the mucous brought up, made from it a slide, and his first glance at it under the microscope, revealed, not only the diagnosis, but also the prognosis of the case. He found the Bacillus Tuberculosis, indicative of *Acute Miliary Tuberculosis*; two weeks later the young lady was in her grave.

This case is a proof of the great utility of the microscope in medical practice.

Dr. W. J. Holland gave an interesting account of the eclipse expedition sent to Japan a few years ago. The talk was illustrated with many photographs.

The other members of the society, as usual, had interesting exhibits of diatoms, vorticellæ and zoophytes.

At the meeting March 12th, about thirty members were present, Vice-President C. C. Mellor in the chair.

Dr. T. L. Hazzard gave an interesting talk on the "Microscopic Structure of the Intestinal Canal," illustrating his subject with many well-prepared slides. Mr. James C. Boyce gave a description of the lenses used in a binocular microscope.

The principal exhibits were:

1. Arranged diatoms exhibited as opaque objects, Prof. Logan.
2. (a) Impressions on wax cylinder of graphophone, Dr. Depuy.
   (b) Section of petrified tree, showing the grain, Dr. Depuy.
3. (a) Anatomy of a gad fly, Herbert Walker.
   (b) Diatoms *in situ* on Alga, Herbert Walker.
4. (a) Zoophyte—Campanularia—from Maine, C. C. Mellor.
   (b) Stomata in leaf of Eucalyptus, C. C. Mellor.
5. Section of human scalp, showing glands and follicles, C. G. Millnor.
6. Pollen of marshmallow, W. J. Prentice.
7. Striated muscles in capillaries of thigh of frog, Prof. Ogden.
8. Bacillus of pal sy, Dr. C. Q. Jackson.

GORDON OGDEN.

EDITORIAL.

IMPORTANT ANNOUNCEMENT.—The next meeting of the *American Society of Microscopists* will be held in Buffalo, *August 20th, 21st, 22d and 23d.* Every microscopist should put a star against these dates, and be present at the meeting. President Lewis has promised us further particulars for our next issue.

INDIVIDUALITY OF THE CELL.—The discovery of Schwann in 1839, that all animals were composed of cells, marks the birth of the science of Biology, and from that day to the present, there has been an almost uninterrupted advance in our knowledge of the histology and functions of animal and vegetable bodies. But until within comparatively recent years, biologists have looked upon the cell only as an integral particle of tissue, much as a mason considers a single brick part and parcel of the structure foreshadowed in the plans of the architect. More and more, however, the observer of to-day is

inclined to recognize in the cell an entity, which is born, lives, and dies, a part of, and contributing to a harmonious whole, and yet leading a partly independent existence.

The time was when the lowest forms of animal life were considered as possessing vitality, and motion, the latter entirely unaccounted for, except perhaps, as the result of outside stimuli. More careful observation, by means of the improved instruments and lenses at our command, leads to the conclusion that there is something in these microscopic creations besides life in the abstract sense,—that a psychic influence prompts them in their whirlings and dartings, and governs their motions, acting in a manner relatively similar to the mental and nervous influences of higher organizations.

A very pretty illustration of this intelligence in the *amœba*,—the lowest but one in the scale of animal micro-organisms, is noted by Romanes in his work on Animal Intelligence. While observing some *Euglenæ*, a Mr. Carter noticed a stalked and triangular *acineta*, around which an *amœba* was creeping and lingering as they do when in quest of food. Knowing the antipathy which the *amœba*, like almost every other infusorian, has to the tentacles of the *acineta*, he was greatly surprised to find that the former crept up the stem of the latter, wound around its body, and placed itself around the ovarian aperture of the *acineta*. Presently a young *acineta* was born, and was received in the unerring and unrelaxing grasp of the *amœba*, which immediately descended from the parent and crept off, to digest its well-earned meal.

M. Binet has recently brought out much in regard to the psychic life of these micro-organisms, and the student of this subject may spend a pleasurable and profitable hour over his recently issued work.

About two years ago Zawarykin of St. Petersburg discovered in the subcutaneous connective tissue of a white rat a peculiar spherical cell. This has since been investigated by Polyakoff, who finds it in various portions of the human and animal body, and whose investigations go to prove that its function is that of fat-forming. The particular point to be noted here is, that these cells, from one and one-half to two times the size of a leucocyte, are elastic bodies possessed of amœboid movement, and wander in the direction of the blood vessels. Here they seize upon the albumenous-food-material of the blood, from which they produce a substance which in chemical composition is probably closely related to fat, but is not fat, but from which at a later period fat is elaborated.

Such discoveries as the above are of vital interest, as by them many important subjects now wholly misunderstood, will be fully and adequately explained, and the "unconscious memory in disease," of which Creighton has written more or less fancifully, will stand out as true psychic phenomena in the cellular elements of the body.

We clip from *The Chronicle*, the University of Michigan, the following item relating to one of the former editors of THE MICROSCOPE:

"The faculty is shortly to lose one of its most valuable and widely known members. Mrs. Stowell, who has been connected with the botanical department, and who has contributed so largely to its success, has been appointed special microscopic artist of the botanical department at Washington, at a salary of $2,000 per year. While we join with our readers in extending congratulations to Mrs. Stowell on account of her new position, yet we voice the sentiment of the students in regretting her departure. No one has had work under her direction, but will testify to her inspiring influence in awakening a true interest in her students for the work in which they are engaged. The lady students will lose a warm friend, while the social circles of Ann Arbor will miss her exceedingly."

Mrs. Stowell has taught this work to pharmacists for a number of years, and only two years ago was elected an Honorary Member of the Michigan State Pharmaceutical Society. Her drawings of the microscopical structure of plants are well known alike for their beauty and accuracy. Dr. Vasey has added great strength to his department by introducing this new method of the study of botany. Botanists and scientific men will be pleased to learn of this new feature to the Government work.

ACKNOWLEDGMENTS.—From H. D. Woodman, Brooklyn, N. Y., slide of sting of honey-bee: from Geo. Rust, Denver, Colo., mount of diatoms from Sweet Water lake,—altitude 11,000 feet.

ZOOLOGY.*

A NEW PARASITE OF AMPHIURA.†—In studying new stages in the development of the young of Amphiurans, Fewkes noticed that a portion of the upper (aboral) surface of the body in certain adults of

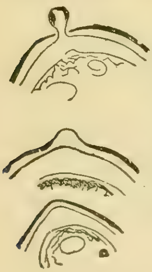
* Under this heading will be included all Abstracts relating to the Embryology, Histology, etc., of Vertebrates and Invertebrates.

† Proceedings Boston Soc. Nat. Hist. Vol. XXIV.

this genus, was of a reddish color, while in most specimens the body is chocolate brown. The brood-sacs of the adults thus affected were invariably found empty of young, and the ovaries had degenerated into an amorphous mass, in which the ova were not recognizable. In the brood-sacs small packets of pink colored ova were found, which gave rise to the reddish color as seen through the body walls. Young Crustaceans, free from the packet of ova, were also found in great numbers in the brood-sacs. These were found to belong to the Copepoda. Fewkes supposes that the parent Crustacean made her way through the genital slits of the Echinoderm into the brood-sacs, and there spayed the Amphiura, leaving packets of her own ova in the sacs to be developed.

BOTANY.*

METHOD OF BUDDING IN THE YEAST PLANT.†—Budding in the yeast plant cell consists in a stretching out or bulging of the outer membrane of the cell-wall. As soon as a small portion of the lining membrane of the cell contents finds its way into the diverticulum, then the outer coat, by its own elasticity, closes around the protruded portion, and causes it to assume the form of a globule, having only a very narrow channel of communication with the parent protoplasmic mass.



BACTERIOLOGY OF SNOW.‡—While the bacteriology of ice and hailstones has been studied with considerable success by Drs. Fränkel, Bischoff, Mitchell Prudden, Pumpley, Hills, Stoben, A. V. Poehl, Bordone-Ufreduzzi, Bujwid, etc., that of snow has been up to the present almost wholly neglected. Even in Russia the subject has been touched only in a cursory way by Prof. A. V. Poehl in a paper on "The Water-supply of St. Petersburg," in the *Vratch*, Nos. 8 and 9, 1884, p. 119. In it he points out: 1, that snow always contains viable microbes liquefying gelatine; 2, that, when snow falls, the first portions invariably contain greater numbers of bacteria than the subsequent ones (for example, 8324 per 1 cubic centimetre of snow-water against 3380 several hours later); 3, that, when snow lies on the ground, the superficial layers become richer in microbes (for

*Under this heading will be included all Abstracts relating to the various departments of Botany.

† Journal of Microscopy, Jan. 1889, page 13.

‡ British Medical Journal, December 15, 1888.—Medical News, January, 1886.

example, 780 just after the fall, against 962 about three hours later). The fact is of interest from a sanitary point of view, as Dr. Poehl's researches furnish an additional proof that exposure of microbes to low temperatures does not destroy their vitality; at least in certain species of micro-organisms. In many countries, such as Russia or Sweden, snow forms, so to speak, a natural ground or soil during several months of the year, receiving excrementitious matter and every possible kind of refuse and filth. In spring, when the snow melts, it is imbibed by the soil, carrying with it all the polluting matters referred to. Hence an interesting question arises: Are such microbes as happen to be present in these matters in any way changed by their contact with snow, or not? This point can be determined only by further bacterioscopic researches.

A contribution to the subject has just been published in the *Vratch*, No. 37, 1888, p. 727, by Dr. F. G. Ianovsky, of Kiev, who has examined bacterioscopically, under Prof. K. G. Tritshel's guidance, a February snow in its purest state, collected both immediately and from one to three days after its fall. This observer has found: 1. That even when collected during its fall, snow is invariably found to contain living bacteria in considerable numbers, varying from 34 to 463 per one cubic centimetre of snow-water. 2. That their number does not decrease from exposure of snow to low temperatures (—16° C.) for several days. 3. That the following three species of microbes are met with constantly in great numbers: *a*, a large diplococcus composed of ovoid cocci, endowed with energetic motion, and characterized by its rapidly liquefying jelly; the test-tube culture on the third day, forming greenish colonies along the track of the needle, assumes the shape of a funnel-like sac with a whitish flocculent deposit, while on the fifth, the whole medium becomes liquified, the precipitate sinking to the bottom: on agar a pale grayish streak is formed at the site of innoculation, on potato a fairly thick white film; *b*, small sized cocci often arranged two and two, energetically mobile, and slowly growing on jelly without liquefying the medium, the growth proceeding slowly along the track of the needle in the shape of a narrow strip consisting of non-coalescing minute points of a yellow color, while on the surface the colony is seen as a grayish-white, circular, slightly prominent patch with somewhat fringed edges; on agar the coccus forms a white streak with sinuous edges, on potato a gray film with a brownish tint; *c*, very large cocci liquefying jelly as late as three weeks after inoculation, and growing along the track of the needle in the form of a sharply defined streak of a beautiful pink color, with a slightly elevated pink circular patch

or "cap" on the surface: on agar the microbe forms a freely spreading white film with a rosy tint; on potato a thick, tallow-like, pink coat with sharply defined fringed contours. 4. That the first two species (*a* and *b*) are also met with commonly in the water of the river Dnieper, which flows through the town (*vide* Dr. Indovsky's bacterioscopic examination of the water, published in the *Meditzinsksiĭ Obozreniĭ* (Nos. 9 and 10, 1888, p. 975), while the peculiar pink micrococcus seems to occur only in snow. 5. That, generally speaking, the microbes liquefying jelly in falling or recently fallen snow are met with invariably in far greater numbers than in snow which has been on the ground for some time; this, in fact, very often contains only such bacteria as do not liquefy gelatine. 6. That the bacteria of snow originate partly from aqueous vapors which are transformed into snow, partly and chiefly from the air: that is, they are carried away by the snow-flakes on their passage through the atmosphere.

MICROSCOPY.*

HINTS ON OCULAR MICROMETERS.—At a recent meeting of the Troy Scientific Association, R. H. Ward, M. D., F. R. M. S., read the following interesting paper:

Recent improvements in ocular scales suggest a consideration as to the qualities desirable in such rulings, the best plan for using them, and the degree of precision in measurement attainable thereby.

The *character of the lines* themselves is an important feature. What is wanted is a true line without appreciable width, but still distinct and conspicuous; while the finest available lines have, when in use, a visible breadth that interferes with sharpness of comparison, at least at one end of the diameter to be measured. It is therefore a matter of skill and judgment to make, or to select, lines sufficiently plain to be readily seen, amidst confusion of details on the stage, and as fine as is compatible with that effect. Lines too fine to be used otherwise are rendered discernible by being filled in with graphite.

It is obvious that lines intended as a rule for measuring, ought to be practically faultless in the *regularity of their spacing*, and fortunately there is no difficulty in attaining such perfection. The best rulings hitherto known, and now available, have errors perceptible under the magnifying power of the microscope, which fact demands great caution in choosing a scale and in verifying or correcting its

*Under this heading will be included descriptions of New Instruments, Microscopical Manipulations, Stains and Re-agents, Photomicrography, etc.

divisions, when intended for a stage micrometer as a standard of measurement ; but they have no errors that can be recognized when used in the ocular as a means of comparing that standard with the object, being then magnified only by the power of the eye-lens or of the ocular, which seldom exceeds 20 or 30 times.

The exact *width of the spaces*, if they are quite uniform, is unimportant. There is no positive advantage in having them laid off to any even fraction of an inch or of a millimeter, except for the chance that they may sometime be required as a stage micrometer ; and many persons do the best of work with a plate without knowing the scale to which it is ruled.

But the relation of the fineness of the ruling to the power of the ocular in which it is to be used, and the resultant *apparent distance of the lines* when in use, determines the reading of the scale and limits its capacities for positive work. It should therefore be carefully considered, and both ruling and ocular be chosen accordingly. If a plate ruled to 0.1 mm. (or $\frac{1}{250}$th inch) be placed in a field of a 1 in. ocular, the apparent width of the spaces may be about $\frac{1}{20}$ in., which, with a 2 in. objective, may be made to correspond with $\frac{1}{1000}$ in. of another micrometer lying on the stage. The ocular scale then reads $\frac{1}{1000}$ths of an inch, and any further nicety depends upon the skill of the observer in guessing, with more or less ingenuity, at the halves, quarters or fifths of a division; just as a carpenter in using a rule divided to eighths of an inch must be satisfied with eighths or guess at the sixteenths. An experienced person with a good eye for distances, can readily locate any given tenth upon an undivided space under easy conditions ; but in the above case he will do well to estimate accurately fifths of a division, and thus read $\frac{1}{5000}$ths in.*

The same process with higher objectives would, evidently, give proportionately higher readings ; but whatever power be used, only one-fifth of the result is positive, the remainder being by guess, and that under rather difficult conditions.

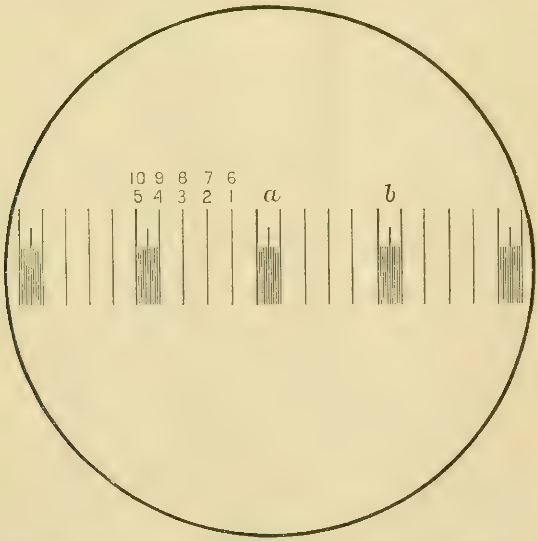
It is therefore advantageous for fine work, to use closer lines, and, notwithstanding the writer's preference for low oculars, to transfer the scale to a $\frac{2}{3}$ or $\frac{1}{2}$ in. ocular, which will further separate the lines. In this case a ruling at $\frac{1}{500}$ in. will present lines at a convenient distance, and will, of course, read twice as finely as the

* The writer has repeatedly made trial of a diagonal line, crossing the parallels obliquely at lengths increasing regularly by tenths of a unit, after the plan proposed by Hartnack ; but he was satisfied that the uncertainty due to a slanting line, which is not at right angles to the diameter to be measured nor usually a tangent to the outline of the object, introduced danger of error greater than that of estimating with the eye fractions of distances between parallel lines. Likewise White's micrometer, with the glass plate cut away from half the field, introduces inequalities of power and definition which seem to more than balance its advantages.

first. Some excellent rulings for this purpose were made years ago by Professor Wm. E. Rogers, at $\frac{1}{1000}$th in. which under the same circumstances would again double the reading; but the lines were, according to the writer's judgment, too crowded for best effect.

More recently Prof. Rogers, before selling his ruling machine, introduced the novel form here shown. The whole scale is divided to $\frac{1}{100}$ths in., leaving the field nearly unobstructed and free from the confusing effect of crowded lines; and these wide divisions may be used (taking advantage of the middle lines in the subdivided spaces as a means of reading halves) with low powers where close work is not required. But every fifth space is subdivided into ten, or $\frac{1}{1000}$ths in., and by using these divisions for decimals, or these for units and the broad spaces for tens, one may gain the precision of the finer scale with almost the facility of the coarser. With a $\frac{1}{10}$th in. objective the coarse spaces may be made, with a moderate use of the draw-tube, to cover $\frac{1}{10000}$ths in., and to read, with the assistance of one of the fine bands for tenths, $\frac{1}{100000}$ths in. A slight change of tube-length will give, with equal facility, a reading by $\frac{1}{4}$ths of a micron (μ), or even $\frac{1}{5}$ths μ for easier relations to decimal notation.

Thus an average human blood-disc may reach from the line marked "2" in the cut to about the 9th line in the fine band "a,"



giving two tens and nine units (29) by direct reading in $\frac{1}{100000}$ths in. Likewise a disc of dog's blood may reach from line "2" to the 7th line of "a"; of beef's blood from "2" to the 3rd of "a"; or of

sheep's blood from "1" to the 9th of "a"; reading respecttively, 27, 23 and 19 one hundred-thousandths of an inch. Thus it would be easy to distinguish between all these except the first two, and possible in that case if we were certain as to the true averages, and sure, which is more than doubtful, that the averages themselves may not vary enough to obliterate the narrow margin between them.

Any one who can subdivide the smallest spaces to tenths, with the eye, can, of course, read in millionths of an inch, or in fortieths μ ; but few persons are likely to go, at any advantage, beyond the record of the finest lines. These appear wide enough apart to estimate in fourths or fifths. But this becomes difficult, if not futile, on account of diffraction, imperfect definition, inequality in the illumination of the scale and of the object, parallax from tremor in both apparatus and observer, and error in making optical contact between the margin of the object and the line from which measurement is to begin; elements which bring a large personal equation into the case, as they vary greatly according to the capacity of individual workers and the quality of their outfit.

The above is intended to show what can be done by a skillful person with good, but common-place apparatus. The ruling may cost, perhaps, a couple of dollars, and a high-power ocular to carry it about twice as much. The objective required for the work is not of unusual power or quality ; and any small, plain microscope of fair quality and good fine-adjustment, can be employed, a lengthening tube being improvised if there be no draw-tube. A screw-movement to adjust the lines in the ocular to the image of the object, or else a mechanical stage for adjusting the object to them, will be of great assistance ; but as the latter, of efficient character and applicable to the most unpretending stands, can now be made for $18.00, it is not a very unreasonable luxury.

Having determined with great care the readings of a ruling with a certain ocular, objective and tube-length, a record of these data is of course preserved, to save time in setting up the apparatus for future use ; and it is too common to depend entirely on such a record, many persons using a scale wholly according to its value as once determined by a friend, or by the maker of the microscope. It cannot be too strongly urged that the highest precision and safety should be secured, at least in all cases of critical importance, as in investigations connected with criminal trials, by a careful comparison of the scale every time, with a stage micrometer of known quality, after the apparatus is set up and ready for use.

With the same apparatus it would require too long a tube, with or without an amplifier, to double the above power and read $\frac{1}{200000}$ths in.; and still more forcing to raise the scale to read microns (the micrometical unit. of 0.001 mm. or about $\frac{1}{25400}$ in.) on the broad spaces, and 00.1 μ ($\frac{1}{254000}$ in.) on the small. This standard, however, is available to those who possess such comparatively rare luxuries as a $\frac{1}{20}$th in. objective (or over) and apparatus to match, with the skill, yet more rare, to use them to advantage. In such case the sheep's blood disc will extend from line "4" to the 8th of "a", or 4 μ and 8 tenths (= 4.8 μ). The human disc will now extend from line "2" to the 4th in "b"; but from "b" to "2" counts 7, giving a reading of 7.4 μ, the upper figures representing the tens from "b" as the lower figures did from "a". Still larger objects would carry the count back toward "10", or beyond; though it would be better to return to a lower power than to attempt fine measurements near the edge of the field. But experts will be likely to use a different micrometer, as follows, with such high powers.

The "filar," or "cobweb" micrometer, a more clumsy, elaborate and costly apparatus, requiring an expert manipulator with a heavy stand, is free from the limitations of the ruled plate and is far preferable for very fine work. Its scale can be arranged to read millionths of an inch as readily as thousandths, while its two movable lines of cobweb or platinum wire leave the field practically unobstructed, and, as seen moving across the flatter field of the positive achromatic ocular, can be brought up to the edges of the image to be measured with great definiteness and precision. The practical efficiency of this method, in exceptionally experienced hands, and from the average of many trials upon very favorable objects, has long been known to reach the limit of $\frac{1}{300000}$ in.: and the writer has often reached the same limit in micro-legal investigations. There seems to be no reason why this record should not be surpassed.

PATHOLOGY.*

DIAGNOSIS OF EARLY PHTHISIS BY THE MICROSCOPE.†—Troup emphasizes the diagnotic value of elastic fibres in cases of suspected phthisis, and says that " in no case will they be missed if sought for with sufficient patience. They are to be found very early in the disease and in the most innocent-looking sputum. They will be dis-

*Under this heading will be included all Abstracts relating to the Histology of Diseased Tissues, both Animal and Vegetable.

†Edin. Med. Jr., July, 1888. Boston M. and S. Jr., No. 8, 1889.

covered before stethoscopic or percussion sounds, even when listened to by skilled ears and interpreted by skilled brains, give any other than uncertain information as to what is going on." They may precede the bacillus often for a considerable time, and unlike it are never temporarily absent. They are not, however, pathognomonic, but if seen the supposition is strong that we are dealing with phthisis, and a supplementary search for the bacillus will complete the diagnosis. Conversely their absence will enable us to assert with confidence that cases are not phthisis, where signs and symptoms point strongly to a contrary opinion.

MICROBES IN DERMOID CYSTS OF THE FACE.*—MM. Verneuil and Clado have examined four congenital dermoid cysts of the face for micro-organisms (France Médicale). In three out of four cases the organisms were found. In these the liquid was obtained a little time before the operation, all necessary preparations being observed. The organisms which were obtained, while of diverse forms, produced negative results on inoculation and seemed to possess no pathogenetic properties. Bacilli appeared to be more numerous than cocci. The authors think that these organisms are carried to the cysts by means of the circulatory system, and suggest the possibility of such a condition as latent microbism.

MISCELLANEOUS.

HOW TO WORK WITH THE MICROSCOPIC DICTIONARY.†—Mr. W. J. Simmons thinks that this valuable work should afford the student something more than a mere work of reference. He therefore has drawn up the following specimen "clue" to what may be designated "treatises" in the work.

List: Protoplasm, p. 641; Primordial utricle, p. 637; Sarcode, p. 674; Cells, animal, p. 137; Cells, vegetable, p. 142; Secondary deposits, p. 686; Pitted structures, p. 600; Spiral structures, p. 711; herein refer to the following articles: Lycopodiaceæ, Ferns, Mosses); Tissue, vegetable, p. 768 (herein also Fibro-plastic and animal); Inter-cellular substance, p. 438; Medulla and Medullary rays, p. 495; Pollen, p. 613; Anther, p. 56; Spores, p. 724; Ovule, p. 565; also the following: Epidermis, p. 294; Hairs, p. 370.

Another way is to draw up conspectuses.

*St. Louis Med. and Sur. Jr., Feb'y, 1889.

†Hardwick's Science Gossip, January, 1889, p. 3.

NEWS AND NOTES.

POE has said, "*Not in knowledge is happiness, but in the acquisition of knowledge. In forever knowing we are forever blessed.*"

THE specific micro-organism of croupous pneumonia is found in the buccal secretion of healthy individuals.

The British Medical Journal says that the King of Greece has conferred on M. Pasteur the Grand Cross of the Savior, which is the highest Greek order. D. Graucher, the director of the Pasteur Institute, and Drs. Roux and J. Guyon, assistants, are made commanders of the same order.

THE age of the late Dr. Carl Zeiss is stated as seventy.

THE bacterial hæmoglobinuria of the ox has been confounded with the bovine pest. It is a contagious disease, and very fatal in the ox; cows nearly always resist it, and calves are refractory. M. Babès describes the bacterium as brilliant, round, and measuring about $\cdot 5\,\mu$; it is divided into two by a transverse mark, and often into four by another septum. The microbe resembles the gonococcus, because it forms diplococci; it has been cultivated on nutritive media at the temperature of the body.—*The British Medical Journal.*

TRANSVERSE section of *Sarsaparilla officinalis* forms an excellent object for displaying starch-granules.

NETTER concludes that pneumonia is a contagious disease of parasitic origin, and is transmitted either directly or by the intervention of a third person, or by inanimate objects, such as wearing apparel, etc.

AMERICAN science works not for the glory of a monarch, as Alexandrine science for the fame of Ptolemy Soter. Neither does it strive to promote the interests of an aristocracy, nor to fill the pockets of a plutocracy. Some such consequence may now and then follow its advance, but only as a by-result of its general contribution to the national welfare. It exists by the people and for the people. To make human life longer, and healthier, and happier is the result, as it is the aim, of modern science; to discover truths and apply them to the welfare of mankind.—*Martin.*

PASTEUR has shown that of seventeen varieties of organisms found in the buccal secretions of healthy individuals, ten of these, when added to fibrin, dissolve it completely.

PROF. W. L. POTEAT, of Wake Forest College, North Carolina, has identified 81 species of desmids in that vicinity. The list is

published in Part 1st, 1888, of the Journal of the Elisha Mitchell Scientific Society.

WE may not be far from the truth, therefore, when we assume that there is a birth, change, and decay of diseases due to very gradual changes in the micro-organisms, which are the causes.—*Theobald Smith.*

THE Dairy Commissioner of the state of New Jersey reports that he subjected 623 articles of food to analysis, of which more than 48 per cent. were found to be adulterated. Of 415 samples of drugs and medicines analyzed, more than 55 per cent. were sophisticated, or below the legal standard.

FIFTY years ago such a thing as a permanent microscopic mount was unknown.

THE last Bulletin of the Illinois State Laboratory of Natural History, is devoted to the description, anatomical and histological, of a new earth worm (Diplocardia communis gen. et sp. nov.) by Mr. H. Garman. The paper is illustrated with fine plates.

MESSRS. H. R. SPENCER & Co., the well known makers of high class objectives, have recently removed their establishment to Cleveland, Ohio, where they will be hereafter known as the H. R. Spencer Optical Co. With increased capital and facilities, we understand that it is their intention to keep in stock a full line of their productions, which they have heretofore been unable to do. They will also open up a new department for manufacturing telescope objectives of any given length to order.

MR. WORTHINGTON G. SMITH finds that genuine honey can be readily distinguished from manufactured honey by the microscope. The former has few or no sugar crystals and abounds with pollen grains, while the imitations have little else than these crystals, with rarely a trace of pollen grains. The honeyed taste of the manufactured article, he thinks, may come from honey-comb or beeswax being mashed up with the article used in the manufacture. Each class of plants has its own specific form of pollen grain, and Mr. Smith says that any one conversant with this branch of botany could tell from what part of the world the honey came by studying the pollen grains that it might contain.

THE *American Naturalist* says that D. H. Blanc describes a species of Protozoa (dromia) which he considers as a member of the genus from the ooze at the bottom of Lake Geneva.

BOOK REVIEWS.

THE PSYCHIC LIFE OF MICRO-ORGANISMS; a study in Experimental psychology. By Alfred Binet; translated from the French by Thomas McCormick. Chicago: The Open Court Publishing Co. Pp. 120.

This exceedingly interesting and unique contribution to the development of instinct in the lowest forms of animal life, opens up a new field for thought and observation, and will doubtless stimulate many to renewed investigations. In the nine chapters which comprise this work, the motory organs and organs of sense, nutrition, the psychology of nutrition, colonies of unicellar organisms, the psychology of proto-organisms, fecundation, etc., are treated of in a clear and comprehensive manner. While some may differ from the conclusions of M. Binet, no one can fail to be interested and instructed by the perusal of his essay, and Mr. McCormack has rendered a real service in placing it within the reach of English readers. The microscopist who desires to keep abreast of the thought of the day, should not fail to read M. Binet's book.

THE ESSENTIALS OF HISTOLOGY, Descriptive and Practical. For the use of Students. By E. A. Schäfer, F. R. S. Cloth; pp. 245. Price, $2.25 Lea Bros. & Co., Philadelphia.

In this work, the author gives directions, by means of which the student can take a systematic course in histology. The book is divided into forty-two lessons, each one of which may be supposed to occupy a class from one to three hours. Full instructions are given as to the best methods of preparing specimens for examination, and this is followed by a description of the tissue thus prepared. The methods employed are of the best, and the histological descriptions are conservative and clearly put. The book is profusely illustrated. Many of the cuts are new, and yet, fortunately, not a few of the old masterpieces are to be found, without which no work on the subject could be perfect. We have been familiar with the work from the time of its first issue, and have found it to answer well the needs of the students to whom we have recommended it.

POPULAR SCIENCE MONTHLY. Vol. XXXIII.

The index of the last volume of this excellent journal shows that it has lost none of its excellent qualities since the death of Prof. Youmans. The intelligent reader of the day here finds a mine of knowledge from which to draw inspiration.

AN INTERESTING SPECIMEN OF TÆNIA SAGINATA. By Frederick Tuckerman. Reprint.

TRANSACTIONS OF THE AMERICAN DERMATOLOGICAL ASSOCIATION, at its 12th Annual Meeting. Boston, 1888,

This volume contains the proceedings of this society at its last meeting held at Washington, together with the abstracts of a number of valuable papers on dermatology, presented at the time.

SECOND REPORT ON EXPERIMENTAL PSYCHOLOGY: Upon the diagram tests. By Prof. Charles Sedgwick Minot.

PREVENTION OF YELLOW FEVER IN FLORIDA AND THE SOUTH. By W. C. van Bibber, A. M., M. D.

THE TREATMENT OF SIMPLE CHRONIC RHINITIS. By Charles Merz, M. D. Sandusky, O. Reprint.

FOOD VERSUS BACILLI IN CONSUMPTION. An open letter from Ephraim Cutter, M. D., LL. D., to his son John Ashburton Cutter, M. D., B. Sc., with answer. Reprint.

NOTES ON RUMBOLD'S METHOD OF TREATMENT OF CATARRHAL INFLAMMATION OF THE UPPER AIR PASSAGES. By Ely McClellan, M. D. Reprint.

SUPPLEMENTARY NOTE ON T. SAGINATA. By Frederick Tuckerman. Reprint.

MICROSCOPY: Reprints from American Naturalist. Dr. C. O. Whitman.

CORRESPONDENCE AND QUERIES.

EDITOR MICROSCOPE:

The article "Cement Varnishes and Cells," by Dr. Lyon, in the March number, is just bristling with useful points. I cannot help but add my little to the general fund. I have also found that every medium of an aqueous or glycerin nature, sooner or later softens all ordinary cell cements. I have mounts of algæ, etc., in copper solution, glycerine, and in solution of chloral hydrate, in cells of solution of sealing wax, and such similar cements, now about three years old; all showing the cement creeping in uniformly toward the center of the mount. All cells to be used for fluid or glycerine (other than alcoholic solutions) should be carefully covered with shellac. This may whiten where the fluid touches it, but it resists well. Cement down the cover with shellac also, and, as Dr. Lyon advises, back it by a more tenacious varnish. Lovett's cement, which is white lead, 2; red lead, 2; litharge, 3; ground together with thin gold size to a working consistence; hardens more quickly than gold size, and seems to be entirely permanent. Mounts four years old prepared with this cement are still perfect in every respect, resisting glycerine, also weak alcoholic solutions. This cement is troublesome to prepare, and cannot well be kept for use like shellac varnish. Cells are, as a rule, made too deep, or too wide. The expansion and contraction of considerable bodies of fluid soon loosen any but very

carefully made cells. Fluid mounts which show signs of failure should, as a rule, be immediately remounted. The presence of air seems to facilitate decomposition. Frequently the bubble is a gaseous result of internal decomposition, which progresses in spite of liberal coats of varnish subsequently applied. Glass slips, with concave centers, should be preferred for many objects. They cost about the same as loose glass cells, and are deep enough for a head of Tænia Solium, etc., and the addition of a ring of thick shellac, well dried, would form a cell deep enough for a wide range of objects. All fluid mounts ought to be revarnished every year, whether they show signs of failure or not. King's Amber or Brown's Rubber, are transparent varnishes, and neither will impair the beauty of any fancy finish. White and black finishing varnishes may be made by adding to shellac varnish, tube oil color, ivory black or zinc white. The resulting finish does not crack, but is not as brilliant as zinc cement or asphaltum. The surface of a glass slip, to which a cell is to be cemented, should be well cleaned with a mixture of equal parts alcohol and chloroform. The best cement would fail to adhere on a dirty glass surface.

Very Truly,

S. G. SHANK.

ALBANY, N. Y.

P. S.—Your March number makes a first-class "specimen copy." Send it around to the outsiders. It is a rich number.

ANSWER 14.—Your correspondent states that the so-called fraud of the Calvert Company, Md., relating to fertilizers, was exposed by the U. S. Department of Agriculture. I think this is erroneous. Mr. Phinn, of New York, the well-known microscopist, was the first, I believe, to expose the erroneous views of the Calvert Company in regard to the value of the admixture of diatomacaeous earth with fertilizing substances. He called my attention to the subject about ten years ago, but I did not write about it, considering that the article published by the company carried with it its own condemnation.

Yours Very Truly,

THOMAS TAYLOR, M. D.

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4. (Ans.)—Mr. Walter White, Litcham, Swaffham, Eng., publishes a list of over 172 botanical preparations which he has for sale. I have tried these and know them to be good, and can recommend them to your correspondent who asks for such.

W. H. SEAMAN.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS *who have microscopical apparatus, material or books which they wish to exchange, and such wants will be* INSERTED FREE OF CHARGE. *The number of insertions given will depend upon the number of exchanges received each month. Subscribers will please notify us when articles have been exchanged or sold. Dealers are referred to our advertising department.*

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H. M. RICHARDS, 27 Ellery St., Cambridge, Mass.

WANTED—Histological and pathological material to cut on the halves. Nothing but first-class material desired. Address C. B. CLAPP, M. D., Danville, Ill.

FOR SALE—Choice slides of encysted trichina spiralis in muscles of cat, with cystic plexus of capillaries injected red; very fine. Write at once for these novelties.
FRANK S. ABY, Iowa City, Iowa.

RARE MOUNTS for sale or exchange: hair of *Ornithorhynchus paradoxus*; mummy cloth, three thousand years old; sections of bark from Charter Oak tree. Address
PROF. H. M. WHELPLEY, St. Louis, Mo.

FOR EXCHANGE OR SALE—For microscopical materials or offers: A good Toepler-Holtz Electrical Machine, 12½ inch revolving plate, and current breaker, Leyden jar, Geissler tubes and numerous other accessories, the whole costing about $60. Will exchange for a good microscope, and pay difference. Correspondence solicited.
F. F. WOOD, Prin. Blair Graded School, Blair, Wis.

WILL EXCHANGE—A complete set, up to 1889, of the Journal of the (English) Postal Microscopical Society, for good mounts, micro-apparatus, etc. Address
A. B. AUBERT, Maine State College, Orono, Maine.

EXCHANGE—Indian curios, Indian blankets, bows, arrows, pottery etc, gold and silver cabinet specimens, polished, petrified wood, turquois, garnets, amethysts, cactus plants, skins of wild animals, etc., all from Arizona; also, one good second-hand Burt's Solar Compass complete. Will exchange any or all of the above for new or good second-hand Abbe Condenser, polarizer, camera lucida, objectives, eye pieces, stand, or other good microscopic apparatus. Address W. N. SHERMAN, M. D., Kingman, Arizona.

FOR SALE—A B. & L. Section Cutter, glass top, and micrometer screw, in perfect order, good as new, cost $7 50; will sell for $5.
H. F. WEGENER, 1305 S Tenth St., Denver, Col.

FOR A CHOICE ASSORTMENT OF MICROSCOPIC SLIDES, send, in exchange, a parcel of minerals and rocks, or of bones and teeth of extinct animals, or of diatomaceous and polycistinous earths, or of diatoms *in situ* on marine algæ. Exchangers will be liberally dealt with. A. J. DOHERTY, 63 Burlington St., Manchester, Eng.

EXCHANGE—Good mounts of animal tissues, human and other, in health and disease, which I offer in exchange for books on microscopy, histology, pathology and bacteriology. Correspondence invited. E. D. BONDURANT, Tuskaloosa, Ala.

WANTED—A copy of Van Heurck's work on Diatoms, bound or unbound. Will pay cash. ALBERT MANN, JR., Newark, N. J.

SALICINE AND ASPARAGINE CRYSTALS.—Extra fine for polariscope. Will exchange for first class miscellaneous mounts. Would like a slide of Trichina and Itch Insect.
B. W. HASKINS, 1985 Euclid Ave., Cleveland, Ohio.

WANTED.—A copy of Rev. William Smith's English Diatoms; also Schmidt's Catalogue of the Diatomaceæ; also cleaned diatoms from Tampa Bay, Mobile and Nottingham. Will exchange or buy. JAMES B. SHEARER, Bay City, Mich.

WANTED.—Vol. III, No. 1, will pay 50 cents for it. Vol. V, No. 5; Vol. VI, Nos. 1 and 9.
LANCET & CLINIC, 199 W. 7th St., Cincinnati, Ohio.

FOR EXCHANGE.—No. 6, Vol. II; Nos. 2, 4 and 5, Vol. III; Vol. IV, complete; No. 1, Vol. VII; for microscopical books or pamphlets. Protozoa or Rotifera desired.
H. H. CODDINGTON, Kalamazoo, Mich.

FOR EXCHANGE—Good histological or pathological mounts in exchange for other good mounts or material, general or special.
S. G. SHANKS, M. D., 547 Clinton Ave., Albany, N. Y.

THE MICROSCOPE.

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VOL. IX. DETROIT, MAY, 1889. No. 5

ORIGINAL COMMUNICATIONS.

CONCERNING THE DIFFERENTIATION OF BLACK PIGMENT IN THE LIVER, SPLEEN AND KIDNEYS, FROM COAL-DUST DEPOSITS.*

FREDERICK GAERTNER,

A. M., M. D., UNIVERSITY STRASSBURG, GERMANY; M. D., ST. LOUIS MED. COLLEGE; A. B., MOUND CITY COLLEGE, ST. LOUIS; CERTIFICATE ILLINOIS STATE BOARD OF HEALTH; CERTIFICATE OF ENDORSEMENT FROM UNIVERSITY OF PENNSYLVANIA; MEMBER IRON CITY MICROSCOPICAL SOCIETY, AND OF THE AMERICAN SOCIETY OF MICROSCOPISTS; MEMBER GERMAN SOCIETY PHYSICIANS AND SURGEONS OF BERLIN; HON. MEMBER OF PHYSICIANS AND SURGEONS OF VIENNA; CORRESPONDING PHYSICIAN TO THE STRASSBURG PATHOLOGICAL SOCIETY, ETC., ETC.

MANY anatomists and pathologists have recently been engaged in trying to solve the problem, how the black pigmentation which is frequently observed in the liver, spleen and kidneys originates; if it can be looked upon as a transportation of black substances from other localities, or as an expression of dyscrasia, especially malarial-dyscrasia.

In the first dicennary of the present century this melanosed condition was considered quite normal, but since, in 1847, by means of the microscope, pigment was found in the spleen, and at the same time was also discovered in the blood of the cadaver, the belief arose that it might have been brought about by intermittent fever, and the discoloration observed in melanæmia was denominated "*Melanotic Pigmentation.*"

*This article is a translation by the author of his original paper, read before the Medical Faculty of the Kaiser-Wilhelms-Universitäte, Strassburg, Germany, preparatory to the examination for an *ad eunden Degree*, and an *Honorary Diploma of Doctorem-Medicinœ-Creat.*

Many authors, especially French, were of the opinion that this pigment was derived from the blood as the result of the destruction of the red blood corpuscles, the coloring matter of the blood (*Hæmoglobin*) being transformed into this black pigment.

These views were accepted until it was proven by chemical tests that this black lung-pigment was identical with coal-dust and soot. In 1878 Soyka narrated a case in the *Prager Medicinischen Wochenschrift*, in which he had observed that the black pigment in the spleen, liver and kidneys was identical with coal pigment; this being the first case cited in literature of which we have any knowledge.

Soyka's case was a man, 70 years old, afflicted with a high grade of pneumono-coneosis, resp. anthracosis of the lungs, in which he also found coal pigment in the liver, spleen and kidneys. Soyka believed that coal dust (pigment) passed through the bronchial lymphatic glands, then through the thoracic duct, and from there was carried into the blood and deposited in the above named organs. This hypothesis Weigert was right in disputing, with the remark that if the lymphatic glands were not continent, every grown person would have such deposits in different organs, which is positively not the case; every grown person, however, possesses more or less anthracotic-bronchial-lymphatic glands: that this black pigmentation is certainly not an expression of malarial-dyscrasia, which is proven by the statistics; that in Germany the malarial forms from which melanæmia is produced, rarely ever occurs, although a deposit of black matter in the liver and spleen is by no means infrequent, as Weigert and Roth have recently affirmed.

The latter author also expressed his views in a lecture published in the Correspondenz-Blatt für die Schweiz. Aerzte, Jahrgang XIV, 1884, to the effect that this pigmentation (pigment) is probably carried by the blood, and is of the opinion that this ought to be looked upon as a coal-dust-metastases. Weigert expresses the same opinion in the Fortschritte der Medicin, No. 14, 1883, in which he explains in a simple and forcible manner the diffusion of coal-dust and soot through the blood-vessels, and states that in Leipzig (Germany), the home of the observer, severe malarial cases never occur, and that therefore, for this reason, and also because the spleens examined are often completely atrophied, the origin of melanæmia (melanosis) should be excluded.

In my mind there is no doubt that the black pigment, which is frequently observed in these organs, presents no material difference

from that of inhaled coal-dust and soot, which is frequently found in normal lungs, especially in those of coal-miners and chimney-sweepers, etc., etc. Concerning this black lung pigment, Knauff says, in Virchows Archiv, vol. No. 39, page 458: "I have never seen the lungs of adults that did not show a black pigment (pigmentation). The lungs of newly-born infants, however, never contain black pigment: those of old people, as a rule, a large quantity."

It is well known that the English first expressed the idea, that this black pigment which so plentifully exists in the lungs of coal-miners and chimney-sweepers, etc., etc., is due to the inhalation of coal-dust and soot.

Pearson was the first (Philosophical Transactions, 1813, page 159), after him Lecann and Melsens, to explain the chemical character of this black pigment contained in the lungs and bronchial-lymphatic glands. They showed that the black mass examined burned without flame, and without leaving any ash behind; furthermore that it was insoluble in nitric, hydrochloric and sulphuric acids and caustic potash or soda, etc., and that it was only acted upon when placed in boiling water through which a current of chlorine gas was passed. It was therefore identical with coal and soot. Then by further chemical analysis, it was found to consist of $96\frac{61}{100}$ per cent. of carbon and $\frac{83}{100}$ per cent. of hydrogen: therefore nearly pure carbon. It was consequently no organic pigment.

Since Pearson, 1813, and later, Laennec, expressed their views concerning the physiological-anthracolic lung pigment: Gregory, Marchall, Thomson, Rilliet and others, during the early part of the present century, acknowledged the possibility of the introduction of coal-dust, particularly soot, into the lung tissue and the production of an exquisite pathological anthracotic lung, as seen in coal miners.

But it is only since Traube's accurate microscropical examination that it has been generally accepted that the discoloration of the lung was due to the presence of coal-dust within the air passages and alveoli.

Following this, it was tried, with success, to solve the problem by experiments, and it is my duty here to mention, above all others, the names of Knauff, Von Ins and Ruppert.

PITTSBURGH, PA.

(TO BE CONTINUED.)

CARDONI of Florence has found in the secretions of acute coryza (head cold) the *Staphylococcus pyogenes*, *Staphylococcus aurens et albus*, the *diplococcus* of Fränkel, and the *pneumococcus* of Friedländer.

THE AFFINITIES OF RAPHIDODISCUS.

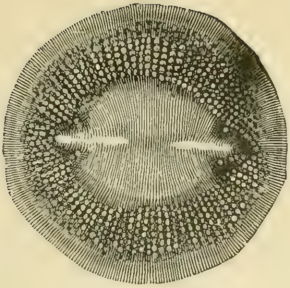
C. M. VORCE, F. R. M. S.

[PLATE VI.]

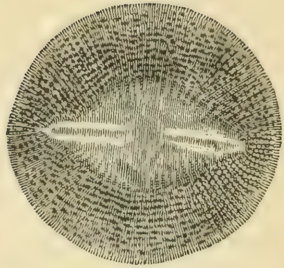
SOME three years ago Mr. Thomas Christian, of Richmond, Va., sent me a small photo-print of what he denominated "the missing link" among diatoms. I regarded it as merely a unique find of two valves of different families, so superposed and so harmoniously constituted in structure as to appear like a single valve; and so wrote Mr. Christian. This was the first time I had seen a figure of the diatom, which was recognized as the same diatom previously described (but not figured, so far as I know), under the name of *Navicula disciformis*, I think, by Mr. Peticolas, of Richmond.

Later on I saw prints of this diatom under the name of *Melonavicula Marylandica*; and, finally, in the MICROSCOPE for March, 1887 (Vol. VII, page 65), the generic description of the same diatom was published by Mr. Christian under the name of *Raphidodiscus*, accompanied by figures and descriptions of three species. Since my first knowledge of this diatom I have hoped to see some further consideration of this much-named diatom and its relations, but, having no specimens nor time to devote to it, could not undertake the task myself. The subject has recently been brought to mind afresh by the receipt of one of the boxes of the Postal Mic. Club containing a slide, contributed by Mr. Christian, of the deposit, in which alone, so far, this diatom has been found; and, having procured and examined specimens of the described species, I have decided to attempt the unraveling of the confusion in which this diatom is now involved. The figures of *Raphidodiscus* are herewith reprinted from Mr. Christian's article. (Plate VI.)

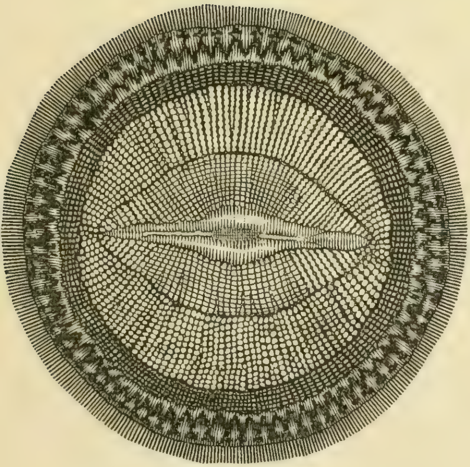
In the published characters of the genus (*loc. cit.*), although the generic name is founded on the presence of a raphe, no mention is made of its presence as a generic character, which are stated to be, in brief, a disciform diatom with cellulate marginal rim, and naviculoid centre with interrupted meridian line, and radiate moniliform striæ prolonged to the margin of the disk. In the description of many diatoms the term "line," or "meridian line," is used in a sense quite distinct from that of a raphe or cleft, and it seems to me the published characteristics of the genus *Raphidodiscus* need revision and limitation. In one of his letters to me concerning this diatom, Mr. Christian referred to it as "upsetting all former theories" of the structure and relations of the Diatomaceæ; in response to which I called his attention to the close approach to this new form of a number of diatoms of other genera, notably some



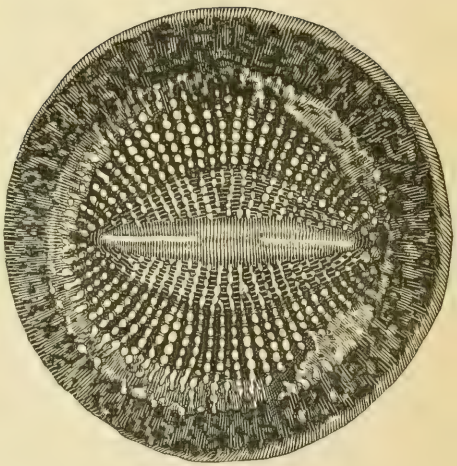
Raphidodiscus Febigerii.



Raphidodiscus Febigerii.



Raphidodiscus Marylandica.



Raphidodiscus Christianii.

PLATE VI.

forms of Campylodiscus, Surirella, etc., and that, so far from upsetting it, tended to confirm former theories as to the structure of the Diatomaceæ.

In the list of genera reported by Mr. Christian (loc. cited) as found in the same deposit, Campylodiscus and Surirella do not appear; but with Actinocyclus, Auliscus, Eupodiscus, etc., which are reported, Campylodiscus usually keeps company, and may reasonably be looked for, where these are found. Species of Campylodiscus are found having a cellulate marginal rim, a naviculoid centre, a meridian line, and radiate moniliform striæ prolonged to the margin of the disk (*C. singalaris*, *C. panduriger Schm.*, *C. exilis*, *Grunow*, etc.) These have not the meridian line "interrupted," but this characteristic is found in *C. Græffii*, *Grun.* None of the foregoing species have "nodules" at the ends of the meridian line, such as are shown in the figures of *Raphidodiscus* but not mentioned in the description. Such nodules are found, however, in *C. imperialis*, *Grev.* and *C. ecclesianus; ibid*, in many of their varieties.

In the genus *Surirella* all of the generic characters of *Raphidodiscus* may be found, even the discoid form (*S. Crumena Breb.*), but nowhere combined in the same diatom. Auliscus, although having in some cases a meridian line and naviculoid centre, has not a cellulate marginal rim.

In the case of fossil diatoms our only basis for judgment as to the classification is the structure of the frustule or valve, its habitat and mode of growth being usually merely conjectural. Guided by the structure of *Raphidodiscus*, what are its affinities and where should it be placed among the tribes, families and genera of diatoms, following the classification of Prof. H. L. Smith, by whom its generic name was assigned? The original name given to this diatom by Mr. Peticolas, *Navicula disciformis*, indicates that he regarded its structure as that of the typical *Navicula*, a flat valve with a central nodule and a true raphe, symmetrically dividing the valve and terminating in a nodule at or near each end of the valve, the specific name relating merely to its contour. The significance of the generic name, *Melonavicula*, under which this diatom next appeared, is not clearly apparent; and, whether derived from Greek or Latin root, was founded on unstable characteristics and was ill chosen, and, for that reason, probably was abandoned.

The latest generic name, *Raphidodiscus*, makes the discoid character of the valve and the presence of a true raphe the basis of nomenclature, and being based on structural characteristics which.

while more or less elastic, are unmistakeable if present, is eminently well chosen and ought to stand. That the discoid character is as well marked a feature in this case as in that of *Coscinodiscus* or *Actinoptychus*, no one, I think, will doubt from an examination of the valves. The only other points of structure to be considered are the naviculoid marking, the raphe and the so-called nodules. Although the naviculoid marking is remarkably uniform in all the valves, some thirty, which I have examined, I can find nothing to indicate that it is any more structural than the blank space in Stauroneis or Pinnularia. I believe that nothing in the growth or development of the valve depends on this naviculoid marking, and especially not on its *shape:* hence, that we may expect to find valves of *Raphidodiscus* with this naviculoid space modified in form, as oval, circular, etc., or altogether wanting. The raphe, having a physiological function as a channel of communication between the interior and exterior of the frustule, is, of course, a structural feature. The nodules, although a recognized feature of classification, are commonly regarded as not essentially structural; indeed, it is only their extremely uniform persistence in the genera of the tribe Raphidieæ that has caused them to be recognized as generic features. I believe, however, that the terminal nodules have, to some extent, structural relations, and that the same is true of the feet, horns, processes and spines of the diatoms generally, especially where they are well marked and uniformly present. I am aware that in many cases the spines are variable, and sometimes nearly obsolete: also, that in some cases the only difference to be discovered between two diatoms is the presence in one case of spines, often minute or obscure, and their absence in the other. I should in such cases regard the form with spines as the typical form, and the other an aberrant form in which a single feature has been suppressed.

In *Raphidodiscus* the terminal nodules are, in my opinion, clearly spinous, the spine, although minute, being fully as well marked as in *Actinocyclus*, in which genus they form a generic character. In *Biddulphia*, *Triceratium*, etc., the spines, as well as the "horns," are clearly structural: in *Stephanopyxis*, *Systephania*, etc., they can scarcely be regarded otherwise: and in *Stephanodiscus* I am satisfied by observation that the spines fulfil an important part in the growth of the frustule, serving by the growth of their opposed extremities to push apart the two newly-formed frustules, and thus widen the connecting zone between the young valves. In *Aulacodiscus* the prominence of the spines and processes strongly supports the idea of their structural character: and I am satisfied that in all

cases the spines and similar processes, where well developed, are important factors in the growth of the diatom, and, where obscure or minute, are lingering traces of a feature being eliminated by the process of evolution.

The spinous discoid forms are mostly found in the third tribe, *Crypto-raphidieæ*, of Prof. H. L. Smith's classification, followed by Van Huerck, in which tribe, however, the *absence* of a true raphe is an essential characteristic. In the first tribe, the Raphidieæ, the absence of spines is equally an essential character, so that either an entire new tribe and family, as well as genus, must be erected to receive *Raphidodiscus*, or else the character of Tribe I or Tribe III must be slightly modified to admit this form. So far as I know, this diatom is the only one which does not fall naturally and easily into one or the other of the three tribes of Prof. Smith's admirable classification, and it would seem far preferable to modify the characters of one of the existing tribes enough to receive this form than to introduce a new tribe of so limited scope as to include but a single family, genus and species; for such, I believe, would be the result of that course. If one of the existing tribes is to be modified, it should be the one containing most of the features of the new form and its nearest allies, and this is obviously Tribe III, which already contains all the features of the new valve, except the raphe.

I suggest, therefore, that the negative characteristics of the Crypto-Raphidieæ, which now stands as "*never* with a central *linear* blank space or true raphe *on* the valves," be so modified as to read "*without* a central linear blank space or true raphe *on* the valve, except a raphe or pseudo-raphe in *Raphidodiscus*."

From examination of a number of specimens, I feel convinced that the three described species of *Raphidodiscus* must be reduced to a single one. The impression conveyed to everyone by the photograph of *R. Marylandica*, that it was a case of two different diatoms accidentally wedged together, is confirmed by the examination of specimens, as the markings of Melosira can be plainly made out when those of *Raphidodiscus* are out of focus, and *vice versa*. *R. Christianii* is simply *R. Marylandica* without the enveloping Melosira; or, more correctly, *Marylandica*, is *Christianii* lodged in a Melosira. *R. Febigerii* is simply *Christianii* with its marginal rim broken away. In a slide belonging to Dr. D. B. Ward, of Poughkeepsie, N. Y., containing six valves of *Raphidodiscus*, one is the so-called "Marylandica," pronounced genuine by Mr. Christian; four are the typical "Christianii," and one is the typical "Febigerii." The valve of "Marylandica" can be clearly seen to be a

double diatom, and can be photographed so as to show either one predominant. Of the four "Christianii" valves on this slide, one has its rim broken away for about one-quarter of its circumference, and it is perfectly apparent that the adjoining valve of "Febigerii" differs from it *only* in having its rim broken away *all around the valve.*

The genus *Raphidodiscus* must, therefore, so far as the forms at present known are concerned, be limited to a single species, *R. Christianii*, and the two species, *Marylandica* and *Febigerii*, must be deleted.

Since the above was written, Dr. Ward has furnished an amusing but conclusive proof of the foregoing conclusion regarding *R. Marylandica*, by the very ingenious expedient of placing a valve of *R. Christianii* into a valve of Melosira and mounting the combination as a single valve. This he successfully accomplished in two cases, and it is found impossible to see the edge of the valve of *Raphidodiscus* in these specimens, although its exact locality is known. Photographs of this combination, which Dr. Ward facetiously calls "Raphidodiscus bogus, N. Sp.," show it to be indistinguishable from "Marylandica," and compare exactly in the structure shown with the photographs sent out by Mr. Christian, labeled "Melonavicula Marylandica."

It follows necessarily that the characteristics of the genus *Raphidodiscus*, having been founded on a combination instead of a true specimen, must be revised. The cellulate margin must be struck from the list, and the raphe and terminal spines must be included. I propose the following description of the generic characteristics of *Raphidodiscus*, viz:

"RAPHIDODISCUS.—Valves discoid, with a central thickening or obscure nodule, and an interrupted raphe terminated by minute spines or spiniform nodules somewhat within the margin of the disc; central portion of disc naviculoid, depressed, its ends terminating at the spines; striæ radiate, moniliform, extending from raphe to the margin of the valve."

As no definite specific description accompanied the figure of *R. Christianii* when published (loc. cit.), I offer the following:

"R. CHRISTIANII, Gascoigne.—Valve flat, with rounding, slightly thickened rim; central nodule obscure, often obsolete; raphe distinct, each part about one-third diameter of valve in length; terminal spines minute, and placed about one-sixth diameter of valve from margin; naviculoid central space large, depressed, and defined by a thickened line or ridge, extending to or slightly beyond

the terminal spines ; radiating striæ coarse, moniliform, and divided towards the margin of valve, where they are again divided and intercalated by short, marginal ribs."

The position of the genus as a spined, discoid form, seems to me to be pointed toward the family Eupodisceæ, which includes forms from which *Raphidodiscus* is only separated by the presence of the raphe, and I would place the genus adjoining *Aulacodiscus* or *Eupodiscus.*

CLEVELAND, OHIO.

MOUNTING IN GLYCERIN OR OTHER FLUIDS.

J. D. KING.

IT makes but little difference what kind of cement is used for cells for glycerin mounts if it adheres well to the slide, does not crack or crumble, and is allowed time to harden so that it will not spread or run in. If tin cells are used they should be covered with a thin coating of cement, otherwise the glycerin will combine with the metal and precipitate a white cloud in the cell.

Make the cell not less than two and half mm. in width. Let it harden till it cannot be impressed with the thumb-nail, and file the surface to an even bearing down to two-thirds the width. A fine single-cut file is best, because it can be easily kept clean with a stiff brush.

Be sure the cell is deep enough so that the cover glass will come down to the even surface of the ring without too much pressure on the object, otherwise it will be difficult to seal it. Centre the slide on the turn table, and cover the outer half of that surface of the cell which has been filed with any strong, colorless cement, but if laid on too thick it will be liable to run off and make a mess.

Place the object in a sufficiency of glycerin just to round up the surface a little above the top of the cell, being careful not to run it over ; too much fluid will be likely to drive out the object besides disturbing the layer of fresh cement. Select a cover glass large enough to cover the entire filled surface of the cell ; breathe on the cover glass, or what is better, dip it in camphorated glycerin, or glycerin and water, to escape air bubles ; place the cover and secure it with a clip ; shake off the overflow of fluid and leave the slide a few hours for the cement to set, when it can be safely washed off under the tap, wiped *perfectly dry* and sealed.

The troublesome leaking of glycerin cells is due in part to the penetrating character of the fluid, and partly to its expansiveness

in warm weather, and therefore a very strong cement is required to hold them, and for this purpose I know of nothing equal to "King's Transparent Cement." white or amber, which were originally prepared for this special purpose. A great spread of cement is not necessary to seal a cell; the main point is to hold the cover glass by running the cement just over its edge, and far enough out on the cell or glass for security. One or two additional coats may be required after the first is hardened. If these simple directions are strictly followed and the work is well done there will not be much trouble with the leaking of glycerin cells.

A glycerin cell may be sealed with heat for greater security, if thought necessary, by applying a clip of gentle pressure after the cover is cemented to the cell, and passing it slowly back and forth over the flame of a spirit lamp till the cell softens a little and the cover glass sinks partially into it, but this experiment is a little hazardous at first.

MOUNTING IN GLYCERIN JELLY.

Glycerine jelly answers more purposes as a mounting medium than any other, but it is dreaded by many on account of the difficulty of getting rid of air bubbles, a difficulty which may be easily avoided by the following method: Heat the jelly in a water bath till the water becomes to the boiling point, then, always working in a warm room, mount with it as you would with glycerin, except dipping the cover in fluid, being careful to remove any stray air bubbles under the dissecting glass before putting on the cover; for even very small ones cannot be depended on to disappear of their own accord. Small or delicate objects can be arranged and kept in place by first covering the bottom of the cell with glycerin jelly and placing the objects in it, being careful to cover them well, and leaving them to harden; when hardened apply additional jelly and put on the cover. After standing over night in a cool place, if the jelly is of good quality, it may be cleaned off under water with a small paint brush and finished with cement.

It is the better way to use cells for glycerin jelly mounts, though it is not necessary to file the surface or apply the cement before putting on the cover glass, or even in all cases to have them as deep as the object is thick; a cell prevents the cover glass from touching the slide at any point and thus creating a liability of forming a vacuum by shrinkage, and it makes better work every way.

EDGARTOWN, MASS.

MICROSCOPICAL LABORATORY NOTES.*

H. M. WHELPLEY, PH. G., F. R. M. S.

DISSECTING KNIVES.—The delicate blades of small dissecting knives are liable to become injured if the instruments are not carefully cared for when not in use. I find that a small piece of thick blotting paper can be slipped over the blade like a sheath to a sword. If the blade is dipped in vaselin before putting it away there is no danger from rust.

GOLD SIZE.—The works on microscopy give complicated and tedious methods for making gold size from linseed oil (*oleum lini*). It is entirely unnecessary to follow them, as the article can be purchased from varnish dealers at fifty cents per pint. It is known as "gold size varnish." It costs more than this to make it by boiling linseed oil with litharge, or passing oxygen through the oil, as one ingenious writer suggests. Gold size can be used as a cement as it is, but I prefer to add about one-fourth the bulk of benzol to thin it, so that it flows more smoothly from the brush.

A VALUABLE LAMP.—I have tried numerous kinds of lamps to find the one most suitable for general use. The most serviceable one seems to be a Pinnefore burner and chimney on a large bracket bowl that is supplied with a handle and an opening for filling the lamp. When arranged with a large white shade the outfit costs but $1.15 and is much more useful than the expensive student's lamps, or special ones made for microscopists. If the light is too low for some work it can be easily raised by placing the lamp on a cigar box or blocks of wood.

BRUNSWICK BLACK—Of late this cement has been made by replacing the oil of turpentine with benzol, which makes a smoother cement and causes it to dry more quickly. It also makes it much more expensive. I find that the rectified oil of turpentine answers nearly the same purpose as the benzol and is not so expensive. It is also necessary to use the true Trinidad asphaltum, and not the ordinary kind that is made into street pavements. I make the cement by dissolving Trinidad asphaltum in rectified oil of turpentine until of the proper consistency and then straining through muslin. To this add nut oil in the proportion of five minims to the fluid ounce of cement.

DO NOT WASTE ALCOHOL.—The alcohol used in washing sections, and many other operations, should not be thrown away, but placed

* Read before the St. Louis Club of Microscopists at the February meeting.

in a bottle labeled "old alcohol," and used in the alcohol lamp for washing balsam off of slides, hardening animal specimens, and numerous other things that will suggest themselves.

ABSOLUTE ALCOHOL.—It is quite expensive to buy absolute alcohol for general use. I heat four ounces of sulphate of copper until it is thoroughly dried, and then add it to one pint of commercial alcohol and shake the mixture thoroughly and let stand for a few hours. The salt takes up the water and turns blue. Alcohol treated in this manner answers most purposes where absolute alcohol is wanted. The same salt can be dried and used over again for another quantity of alcohol.

LABELING SLIDES.—Not every one stops to think how much more convenient it is to have the principal label on the left hand end of a slide. We naturally pick up a slide with our right hand and grasp it by the right hand end. This covers up the label on that end, so I make it a practice to place the label on the left hand end; or, if two labels are to be used, I put the main one on this end and the less important one on the right.

ACACIA CEMENT.—I find that a useful cement for finishing off balsam mounts is made by dissolving acacia in water and precipitating it with alcohol and thoroughly washing the precipitate with alcohol until only insoluble matter remains. Make a saturated aqueous solution of this. To one fluid ounce of the solution add four drachms of the C. P. hydrated aluminum, two fluid drachms of glycerin, and the same quantity of water, and then strain through muslin. This cement drys quickly and can be followed with a coating of any other cement desirable.

A CLEAN CLOTH.—It is customary to have an old silk handkerchief convenient for the purpose of wiping off objectives, cover glasses, slides, etc. It is also quite common to see this cloth left out in the dust and dirt. I keep the piece of old silk in a tight box, so that it is not gathering dust when not in use. When it becomes soiled it should be washed.

BALSAM BOTTLES.—The mouth of a balsam bottle is usually smeared with balsam, so that the pipette soon becomes dirty and sticky. In order to avoid this I bend a piece of wire in the form of a quadrilateral and about the size of the greatest dimensions of the inside of the bottle. When this is placed in position the upper end serves as a support to scrape off any superfluous balsam from the pipette. If carefully used the lip of the bottle can be kept perfectly clean.

THE ALCOHOLIC METHOD OF MOUNTING BRYOZOA POLYZOA—NOTES ON TECHNOLOGY.

V. A. LATHAM, B. SC., F. R. M. S.

I HAVE been trying to avoid the alcoholic method of mounting as it is difficult to render the slides permanent, especially as regards the cement. If it is wished to preserve them in alcohol I use brown cement; but not by itself, as the spirit affects it. Ring a cell of the brown cement and allow it to harden thoroughly; cover this entirely with balsam and benzole, and, when dry again, make it slightly sticky by a thin line of balsam, which fastens down the cover glass. Ring over all another layer of the last cement, and, when dry, use brown cement to completely seal the mount, which, when dry, can be finished as the mounter wishes. If, instead of the above method, after the organisms have been fixed and colored, pass them through alcohol 30 per cent., 50 per cent., 70 per cent., and absolute the last, at *least* twice, and let it stand covered for 24 hours. Replace the spirit by pure benzole; remove about a tenth of the alcohol in which the organisms are placed with a pipette, and replace by the same amount of benzole; repeat this a number of times (about 12) at intervals of from ten to thirty minutes. Great care must be taken that the benzole mixes thoroughly; after the last addition pour it off and substitute pure benzole. At the end of 24 to 48 hours in the benzole, which depends upon the size of the object, a fifth part of C. balsam dissolved in benzole is added; repeat this at intervals of from a quarter to half an hour; the objects may now be preserved in the tubes till wanted, or mounted at once. In mounting care must be taken that each drop holds in suspension a sufficient variety of the organisms. The method is not quite so tedious as it appears from the reading.

STAINING, CANCER OF THE BREAST.—I find ink to be a useful, handy stain; also in secondary cancer, sections from Fallopian tubes, etc., especially if Steven's blue-black ink is used, which is better than the black.

SLIDES OF BLOOD.—Heat a slide, allow a drop of blood to fall upon it, and immediately (but lightly) wipe off; in this manner a sufficient quantity is dried on before the corpuscles have time to form in rouleaux or change shape. It is a good method of mounting blood from different animals, etc., for comparison.

STAINING SMALL INTESTINE TO SHOW PEYER'S PATCHES.—Stain in picro-carmine; wash lightly in water acidulated with acetic acid;

now stain in a solution of iodine green until it becomes slightly green; quickly wash in water and mount in damar, taking care it does not remain *too* long in the alcohol. All glands, especially Peyer's patches, are green, connective tissue red, submucous layer stands out bright red, mucous mucosæ and muscular coats yellow. I find in preparations steeped in $Os\,O_4$, after hardening in cr. acid mixture, various details are seen with equal clearness.

A MODIFICATION OF BALSAM MOUNTING.—After staining and washing the sections, I remove the water as usual by allowing the specimens to FLOAT in methylated spirit till it *sinks by its own weight* (NEVER PUSH SECTIONS UNDER); then place in weak alcohol; follow by absolute for some minutes; then place them on a slide and allow them just to become sodden; place a drop of clove oil *beneath it* by means of a sable hair brush (camel hair not stiff enough). The oil rises through the section and drives away the spirit. When all is given off, finish the clarification by touching the upper surface of the section with the oil. Mount in C. balsam or damar, ring, etc. This seems much more tedious than it really is, and, as I have never heard of it before, I venture to bring it before your readers. I tried it for sections arteritis obliterans and brain in syphilis, etc.

STAINING FAT CELLS IN THE FASCIA OF A CALF'S NECK.—After soaking for from one-half to three hours in a half per cent. solution of osmic acid the portion of the fascia is placed for fifteen minutes in a solution consisting of carmine, $\frac{1}{2}$ drachm; borax, 2 drachms; water, 4 ounces. It is then washed quickly and mounted in glycerin, to every ounce of which two drops of formic acid have been added.

LOPHOPUS CRYSTALLINUS.—Alcohol is used in mounting the above with the tentacles expanded. The spirit is blown as a spray upon the surface of the water containing the organisms; it mixes slowly, and the tentacles are thereby *not* retracted.

TO MOUNT PERMANENT SLIDES OF HÆMOGLOBIN.—The crystalline mass may be spread out with needle on a warmed slide, then covered; or else treated (I) with absolute alcohol, (II) spirits of turpentine and nited C. B.; or they may be mounted in pot. bichromate two per cent., and before applying cover-glass, allow to dry completely, then add Damar varnish and cover as usual.

TO OBSERVE SPROUTING OF SPORES INTO BACILLI.—Drops of cultivating fluid are placed on a series of cover-glasses; they are then inoculated with spores of the bacilli, inverted over glass cells, sealed with vaseline, and placed at a temperature of 36° C. Slides may be

removed at various intervals of time, the fluid rapidly dried on cover glass. Stain and mount in C. Balsam.

TO OBTAIN BLOOD FOR MICROSCOPAL EXAMINATION.—Remove all hair from the spot to be punctured: clean the skin carefully with warm water and soap; place a drop of 0.8 per cent. salt solution on the spot, and, with a knife which has been previously heated, cut through the skin; then, with another knife, cut a small artery or vein. Only in two diseases are bacteria regularly to be found in the blood of living, *i. e.*, in *anthrax* and *febris recurrens*. The anthrax bacteria withstands the action of most reagents, while the spirochœte of recurrent fever are readily destroyed by addition of fluids, even by distilled water.

MOUNTING MEDIA.

HENRY SHIMER.

WHILE reading the editorial in the last November number, Vol. VIII, p. 337, I felt like saying that I am using a new formula mounting medium with great satisfaction :

Glycerin jelly	1 part.
Farrant's solution	1 "
Glycerin	1 "

The glycerin jelly I made thus, the strong solution from "Whiteman's Methods" modified (after Fol.):

Gelatin	30 parts.
Water	70 "
Glycerin	100 "
In the place of the camphor (alcoholic) I put	
Carbolic acid	2 "

The Farrant's medium, same formula as published in THE MICROSCOPE.

Of this glycerin jelly, liquefied by the heat of a water-bath, pour one fluid ounce into a four-ounce glass-stoppered bottle, add an equal volume of the Farrant's medium and of glycerin. A little gentle agitating in a water-bath will soon insure a complete mixing. Into this bottle drop a small lump of camphor. From this stock solution pour out a little into a morphine bottle, say one-third or one-half full, for a working-bottle. In this keep a twisted No. 16 to 24 wire (copper is better than iron), passed through the center of a wooden cork cut flat and tapering, so as not to stick ; or get a

tin pill-box lid of a size to just cover the bottle. Pass the twisted wire through this, and have a tinner make it fast with solder.

This medium needs a little warming, about 110° Fah., to make it fluid for use, which is easily done over a common kerosene lamp. A little ingenuity will construct some kind of scaffold to hold a piece of heavy sheet iron about an inch above the lamp chimney ; on this place a flat tin box, or pan 4 x 8, x ½ inch deep, filled with sand. A tin cover lid over this makes a cheap and very satisfactory warming plate, on which the working bottle can be placed, and in a few minutes is ready for use. Even an empty tin fruit can with a little sand in the bottom, may form a substitute. However, some kind of warm plate is indispensible to him who would prepare microscopic slides.

I have a few dozen slides made in this medium several months ago, "neglected," of a ring of cement, to test it in comparison with Farrant's medium, and I find it just as good in this particular; as the latter does not take in air by drying under the edge of the cover, as does the glycerin jelly mount, when thus neglected, when enough of the solution is placed on the section. Both this and the Farrant's will take in air by retraction when too little of the solution is used.

It is a much better working solution than Farrant's. When we wish to mount several specimens under one cover without fixing, it flows as nicely as soft balsam or glycerin; while the Farrant's solution, being a viscid medium, displaces the sections, even floating them out from under the cover, and it is more prone to leave large air bubbles.

Furthermore, theoretically, my solution ought to be a better preserving medium, glycerin being the preservative.

My Solution—Glycerin, 56 per cent.; water, 25 per cent.; gelatin, 5 per cent.; gum arabic, 14 per cent.

Farrant's Medium—Glycerin, 20 per cent.; water, 40 per cent.; gum arabic, 40 per cent.

The above formula of glycerin jelly gives glycerin 50 per cent.; water, 35 per cent.; gelatin, 15 per cent. Kaiser's glycerin, a much used form, gives glycerin 50 per cent.; water, 43 per cent.; gelatin, 7 per cent.

The heat required to liquefy my medium is not great enough to injure the most delicate tissues. Place the mounted slide in a drying box; it sets in a few days so as to hold the cover glass firmly, after which, at any convenient time, fasten it with a ring of shellac

varnish, or other cement, to guard against dampness and accidents. As a mounting medium it is equal to glycerin, while it is free from its imperfections, and is second only to balsam, which makes a little clearer specimen, especially if it be a wood or plant section; it deserves to go into general use side by side with balsam. If we want the solution thinner, use glycerin jelly 1 part; Farrant's sol., 1 part; glycerin, 2 parts; which contains, glycerin, 67 per cent.; water, 19 per cent.; gelatin, 4 per cent.; gum arabic, 10 per cent. This sets very slowly and does not check under; or, if we use three parts of glycerin, we have glycerin, 74 per cent.; water, 15 per cent.; gelatin, 3 per cent.; gum arabic, 8 per cent. This sets rather slowly, but is useful where glycerin mounting is the ideal, the small per cent. of gelatin and gum arabic still being enough to hold the medium under the cover.

Of these three combinations I am led to prefer the first.

PROCEEDINGS OF SOCIETIES.

THE ST. LOUIS CLUB OF MICROSCOPISTS.

AT the meeting on March 12, Frank Davis reported on the examination of balsam of tolu, and exhibited specimens made by placing a drop on a warm slide and covering it with a cover-glass. The specimens showed crystals of cinnamic and benzoic acids and parts of insects and other foreign matter. The most crystals were found in the balsam taken from the under side of the cover of the cans. Professor Whelpley showed mounts of hair from the *ornithorhynchus paradoxus*, and pointed out its peculiarities; also roots from a sweet potato sprouted in water. He demonstrated the root cap and explained its function. The remainder of the evening was devoted to the examination of specimens from the club's cabinet.

SAN FRANCISCO MICROSCOPICAL SOCIETY.

A REGULAR meeting of this society was held at its rooms on April 10th, 1889; President Poyzant in the chair.

Mr. Leckenby spoke briefly of the difficulties often experienced by the tyro in manipulating the numerous forms of insect life for slide-mounting and lantern projection, and proceeded to describe the method pursued by him as embodying the result of many years of patient application to the subject. Starting with the coleoptera, or beetle family, the first step is to devitalize them quickly and while

they are in flight, which the gentleman accomplishes by dropping them through a long glass tube into boiling water. The elytra and wings are by this means immovably fixed in the extended position, and remain unaltered during the subsequent operations. The body of the insect is then injected hypodermically with a strong solution of caustic potash and allowed to remain three or four hours, then transferred to a glass slip and gentle pressure applied, when the viscera and other tissues forming the interior of the body will be expelled. To dehydrate or remove the watery portion, absolute alcohol is generally recommended, but the lecturer contended that it was expensive and not always at hand, while equally good results would follow by placing an ounce or two of refined gelatin in a vessel, pouring on alcohol of 95 per cent., and immersing the object for a short time—the gelatin, from its affinity for water, absorbing that fluid from both the object and alcohol.

The insect is then placed in oil of cloves to clear or render it transparent, and is ready for mounting permanently in balsam. By this method the insect is rendered entirely transparent, the peculiar geometrical marking of the wings, the abdominal and thoracic rings and the various parts forming the head and limbs are beautifully displayed.

In preparing the lepidoptera, a somewhat different course is pursued, as the wings of all butterflies and moths, being covered with easily detached scales, must be protected. The butterfly or moth is placed on a square of glass and liquid paraffin flowed carefully over the entire insect. After cooling, a small aperture is made, exposing a portion of the body, and caustic potash injected; the subsequent operations being the same as for beetles, excepting that sulphuric ether must be used to dissolve off the paraffin, leaving the soft, velvety covering of the wings unimpaired.

In this manner are prepared the beetles, dragon-flies, bees, wasps, caterpillars, etc., and when mounted in balsam they form some of the most beautiful and instructive objects imaginable, whether viewed through the microscope or reflected on the screen. Mr. Leckenby exhibited many fine specimens of his handiness in preparing and mounting the different orders of the insect world, noticeable among which were a gigantic tarantula spider, several gorgeous members of the Papilio genus, fierce-looking dragon-flies, beetles, wasps and a large collection of small objects.

The lecture was followed throughout with the closest attention, and at its conclusion the interest in the subject was so manifest and

expressive from those present that Mr. Leckenby generously offered to donate a future evening to a more extended demonstration of mounting in balsam.

The advisability of having an annual reception was discussed among the members, and a motion favorable to the proposition of holding one carried, the details to be arranged in the near future.

Dr. Harkness made some excellent remarks bearing on the subject of microscopical receptions here and in Europe, which were listened to with pleasure, and will probably be stored away in the memory of the prospective Committee of Arrangements.

The acquisitions to the library consisted of the usual microscopical miscellany, while the cabinet was increased by a fine slide of Mentzelia from Colorado, donated by Mr. Leckenby.

C. P. BATES,
Recording Secretary.

EDITORIAL.

IT has been said that "seeing is believing," and to the great majority of mankind nothing seems truer. But there exists an over-exacting minority who not only will not rely upon the evidences of the unaided senses, but must need inquire with tedious minuteness into the conditions under which the evidence was obtained. They prate learnedly of the influence of the mind on the senses, of preconceived ideas and inherited conceptions, and go so far in their devotion to cold truth as to attempt to shatter the lovely idealizations of which the senses are master creators by introducing the exact sciences in rebuttal. But what is yet more unfortunate, this dreadful tendency of a minority is working as leaven on the majority, and when it is considered that leaven is sour dough and that it affects the mass not through substance but through the more reprehensible mode of gaseous emanations, the matter becomes doubly unfortunate. As a result of this disbelief in the senses the gruesome spooks and goblins and the delightful Brownies—visible companions of our forefathers'—are moving in this springtime of new methods from their former abodes of fact to the more permanent though none the less delightful ones of fancy. All this means that there is a growing belief that our senses need educating, and although this education is progressing, it is far from complete.

The microscope may be said to give us a new sense, a sense which, as it were, allows us to see the invisible; and with whatever

circumspection we interpret the evidence of our natural senses, it should be doubled when dealing with this new sense. With the latter we have no advantage from inheritance, nor can the other senses, as touch, taste and hearing, be brought to bear as corrective aids. Thus handicapped, each must begin from the bottom and learn to make correct interpretation for himself: and so difficult is it to attain perfection in this regard that the most eminent microscopists never forget their own shortcomings and to attempt correctness by doubly observing, and to know even then when to remain in doubt.

WE publish in this issue a letter from Mr. Neudorf, endorsed by Mr. Grose, in which the gentlemen claim to have resolved a ruling having 220,000 lines to the inch. As the possibility of such a feat has been thoroughly discussed in this journal, we shall make no criticism of the statement other than to quote from the *Royal Microscopical Journal* these remarks on a like statement made last year by Mr. P. H. Dudley: "A good deal of amusement has been felt in the Old World at the vagaries of part of the New over these plates. As Old World microscopists are aware, it is one of the plainest and best established scientific truths that there is a limit to the number of lines to the inch that can be made visible to the human eye with our existing optical appliances, and to believe that more have been seen relegates the believer to the ranks of those who believe in perpetual motion, the creation of force, squaring the circle, and other self-demonstrated fallacies.

"Our American brethren are not one whit behind us in their appreciation of scientific principles, and it was therefore puzzling to read from time to time positive statements that many people had seen 200,000 lines to the inch—the limit, even with the maximum aperture of 1.52, being 158,845. We put out of account the statements of the ruler of the lines, as he may be forgiven a not unnatural tendency to see lines that he feels certain his acknowledged mechanical skill has really put on the slide."

We cannot but think that Mr. Fasoldt, whose mechanical skill and rulings need no commendation, is imperiling both in allowing statements so at variance with the best established scientific truths to be given out. People who persist in seeing that which is not to be seen must bear the reputation of Columbus, who sailed away under the then delusion that the world was round. He gained no glory in his going: it came only with his triumphant return. And when the gentlemen who have gone out into those mysterious provinces which lie beyond the realms of science return laden with strange fruits and

curious things, then, and not till then, shall we hear the pæns arising from the throats of a never-credulous minority. We cannot, therefore, publish further communications on this subject unless accompanied with mathematical or other exact demonstrations proving the physical practicability of such feats.

WE publish with this issue a portrait of our lamented friend, Mr. Henry Mills, which should have accompanied the obituary notice by Prof. Kellicott in our March issue. Mr. Mills' death is a loss to the scientific world which will not soon be filled.

MICROSCOPY.*

KULTSCHITZKY ON THE EGGS OF ASCONS.†—In studying the conditions of impregnation in the *ascon's megalocephala*, Kultschitzky employed Van Beneden's acetic acid-alcohol, p. e., as a killing and hardening agent. He also found that 3 parts æther and 1 part absolute alcohol, with acetic acid, or the acid-ether, diluted with one-third distilled water, gave excellent results. For staining, acetic acid-carmine was generally employed, although Bismarck-brown and malachite-green (Van Beneden's), as well as aurantia and an alcoholic solution of gentian-violet were occasionally employed, but were found of little service. Although most observers of the eggs of a *megalocephala* have mounted their specimens in glycerine, Kultschitzky found that as good or better results were obtained when balsam was used. He gives the method of procedure. The stained preparation is dehydrated in acetic acid, and then placed in a mixture of acetic acid and balsam. The section thus treated shows up well, but in time becomes darkened. To avoid this, the section is dehydrated in equal parts of alcohol and acetic acid, cleaned in creosote, and inclosed in creosote-balsam. Preparations thus treated are permanent.

MAYER'S ALBUMEN FIXATIVE.—Mr. J. Nelson finds‡ that this fixative is absolutely reliable. One cannot obtain neat results with this, he says, except by means of a very *even* and *thin* film, to secure which proceed as follows: A small drop of fixative is spread on the slide with the ball of the index finger. Excess of fixative is

* Under this heading will be included descriptions of New Instruments, Microscopical Manipulations, Stains and Re-agents, Photomicrography, etc.

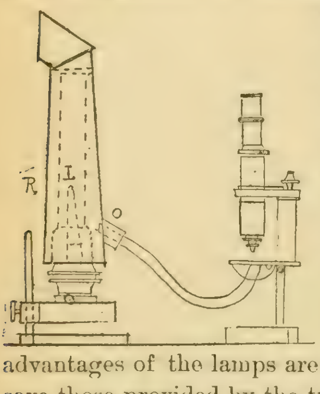
† Arch. f. mikr. Anat., Bd. XXXI.—H. 4.—1888, p. 570.

‡ *American Naturalist*, July, 1888, p. 664.

removed by wiping the finger dry and continuing the rubbing until no frothy streaks appear in the film. Then tap the moist surface lightly with the finger, so that by light reflected at a proper angle it appears pebbled or stippled. Each section is pressed into the film with a brush, and when the slide is full a piece of filter-paper is placed over all and firmly pressed with the finger until every part of each section is in even contact with the glass. Then heat the slide over steam until the paraffin melts, and then plunge into turpentine. The film is opaque in alcohol, but this is corrected in turpentine and mounting. Mayer's fixative consists of the filtered white of eggs with an equal volume of glycerine, and a little carbolic acid as a preservative.

SOAP EMBEDDING.—Pfitzer recommends a modification of the soap embedding process for a study of developmental processes. A mixture of equal parts of glycerine and 96 per cent. alcohol is saturated at 60°—70° C. with finely-shaved, transparent glycerine-soap. The plant parts taken from strong alcohol, are brought into the mixture before it sets by cooling, or they can be penetrated by allowing them to lie in a similar cold-saturated solution of soap. This embedding mass keeps without change in corked vessels, and becomes fluid at 40° C. The action of the alkali of the soap renders the sections particularly clear.—*Botanical Gazette.*

THE KOCHS-WOLZ MICROSCOPE LAMP.*—This lamp was exhibited at the last meeting of the German naturalists at Cologne. It consists of an ordinary petroleum hand-lamp; having an external dark (R) chimney, the inside of which is a reflector. The only opening through which light can pass is at (O). Into this short tube a cork is inserted, which in turn is perforated by a glass tube having a diameter of about 1 c. m., bent at any desired angle, and carried either below, or above the stage, as translucent or opaque objects are examined. The advantages of the lamps are that the eye encounters no ray of light save those provided by the tube; the apparatus can be used with any microscope; the light is steady, uniform, cool, diffuse and agreeable to the eye; white light may be obtained by placing colored glass over



*Manufacturers' Circular, also, Schiefferdecker in Zeitsch f. Mikr., Bd. V., H. 4 p.

the end of the tube. Schiefferdecker states that while this little lamp is quite convenient, the light is too yellowish-red, and that if this is corrected with colored glass, the light is not intense enough for the use of high powers. He has therefore suggested that the Auer gas-light with corrective glasses be used, and Wolz is now experimenting in this direction.

WHITMAN (*American Naturalist*) finds that Labarraque's solution, hypochlorite of sodium, is an excellent solvent for the gelatinous envelope of the amphibian egg. He employs a 10 per per cent. solution diluted with five or six times its volume of water. Care must be taken not to expose the eggs too long to the solvent action of the fluid.

PATHOLOGY.*

BACTERIO-THERAPY OF SPLENIC FEVER.†—A. D. Pawlowsky has published a contribution to the study of "bacterio-therapy," in which he states that he has finally concluded, after a long series of experiments, that it is possible to cure splenic fever by means of bacteria. Splenic fever, anthrax, charbon, malignant pustule, or bloody murrain, as the disease is variously called, is an acute infectious disease, affecting herbivora and omnivera for the most part, but communicable to other mammals, including man. The specific cause of the disease has been proved to be the bacillus of anthrax, or its spores. Inoculations as a prophylactic against anthrax were first instituted by Burdon Sanderson and others in 1878. The results obtained by these experiments were very successful. Other methods have since been tried, but probably that of Toussaint is as simple and effective as any. The latter consists of heating the virus for one hour, at a temperature of 131° F., so as to diminish its activity, and then inoculating the animals to be protected. Pawlowsky, however, seems to have developed some new points in his experiments. From a review of his paper in the *Deutsche Medizinal-Zeitung*, November 14, 1887, we learn that cure of the local anthrax can be obtained by means of a series of subcutaneous injections of different microörganisms, at the point at which the disease originated or in the neighborhood of these. The most powerful antagonist to the anthrax bacillus was found to be

* Under this heading will be included all Abstracts relating to the Histology of Diseased Tissues, both Animal and Vegetable.

† Virchow's Archiv, Bd. CVIII, Heft 3. Medical and Surgical Reporter, Phila.

Friedländer's diplococcus of fibrinous pneumonia. This, at least, is the inference which Pawlowsky draws from the fact that all of the eight rabbits suffering with anthrax, which were injected with it, recovered. The staphylococcus aurens stands next in efficiency to the diplococcus of pneumonia: as four rabbits, which were treated with it by hypodermic injections, recovered. It is somewhat surprising to learn that non-pathogenic organisms are capable of curing local anthrax. This the author declares to be the fact, and places the bacillus prodigiosus third in effectiveness. In the case of this bacillus a single hypodermic injection was not successful, but a second resulted in cure. Of ten rabbits which recovered from anthrax after treatment with the bacillus prodigiosus, eight have subcutaneous suppuration at the spots into which this bacillus had been injected. Finally, the fourth place as a remedial agent against the anthrax bacillus is accorded by the author to the streptococcus of erysipelas. Of seven rabbits treated with it, only two died.

Coming now to the treatment of general splenic fever with intravenous injections, it was found that proportionately favorable results were obtained only when anthrax bacilli were injected simultaneously with the diplococci of pneumonia. Of seven rabbits treated in this way, two recovered, three died of embolism, and two of anthrax. If the injection of anthrax bacilli was followed by that of the diplococci, instead of both being given at the same time, the results were not as favorable. This is clear from the fact that of five rabbits which were so treated not a single one recovered. It is important to note, however, that instead of dying as animals unprotected from anthrax usually do, in from thirty-six to forty hours, the rabbits in question survived from seven to fourteen days, showing that the injection had enabled the organism to maintain the struggle against the disease for a long time. Intravenous injections of staphylococcus aurens did not save the animals from anthrax: while injections of streptococcus of erysipelas and the bacillus prodigiosus lengthened the struggle of the animal against anthrax to from three to five days.

BACTERIOLOGICAL RESEARCHES IN CONNECTION WITH SUMMER DIARRHŒA.*—Dr. Henry Tomkins brought this matter before the British Medical Association at its recent meeting in Glasgow. He alluded more particularly to the subject as he had studied it in the town of Leicester, where he resided.

In approaching the subject two facts were to be borne in mind

* The British Medical Journal, August 25, 1888.

—(1) that all diarrhœas, not some diarrhœas, were often only a symptom of varied morbid conditions, as pointed out at the Cardiff meeting of the British Medical Association by Dr. Vacher; but, after all due allowance made, there undoubtedly remained a large residue of cases of a specific or special nature, constituting a disease *per se*, as much so as true Asiatic cholera: (2) that that disease was not a disease of infancy or early childhood only, or even for the greater part. Exact observations showed that the bulk of sufferers from it where it prevailed were of more mature years, though, owing to the mortality occurring almost exclusively amongst young children, this fact had often been overlooked. Of all English towns, Leicester was, *par excellence*, the home of this disease, if its mortality was to be taken as a true criterion of its prevalence. During the past three years, since holding the office of Medical Officer of Health there, Dr. Tomkins had paid special attention to the subject. It was easy to disprove that many of the reputed cases gave no satisfactory explanation of the production of the disease. Many of these affect only the infantile population, and affect these more or less throughout the whole town, whereas the prevalence of the disease was confined to certain well-defined low-lying districts of the town and affected all ages and occupations, etc., within those districts. The cause must be something common to every resident within those districts, which something was apparently absent in other parts of the borough. The only things or conditions common to all were food supplies, water and air. The two former were the same throughout the whole town. There remained, therefore, only the air. During the past three years Dr. Tomkins has undertaken a large series of observations on the air, with special reference to the microbic forms of life contained therein. The general result showed that the air of the diarrhœa district of the town contained three to six times as many micro-organisms or their germs as the air of the non-affected districts. These microbes (or certain of them) grew in a distinctive manner when artificially cultivated, and were capable of producing diarrhœa, or perhaps, more correctly speaking, the products of their artificial cultivation were capable of producing diarrhœa in the human subject. At present Dr. Tomkins was endeavoring to isolate and single out the particular form or forms which were most concerned in this. The organisms and growths obtained from various tissues, organs, and intestines in fatal cases of diarrhœa give like results. A very probable explanation of the undue prevalence of diarrhœa in Leicester, or rather in certain parts of that town, was found in this excess of aërial microbes and germs, and

this excess might be satisfactorily accounted for in the following way: Since 1850 (from which date the prevalence of diarrhœa appeared to have commenced and increased) the whole of the area of the "diarrhœa district" of the town had been subjected to a pollution with organic filth, more or less of an excremental character. This, acted upon by the heat of the summer sun, amply sufficed for an enormous production of bacteria. Imperfect and filthy sewers, containing much deposit, in the same way contributed to like results. Meteorological observations during the summer months of 1885, 1886, 1887, showed that as soon as the earth at a depth of one foot reached about 62° F. the disease broke out. At the time of writing (July 23d, 1888) this subsoil temperature had not yet been reached, and the outbreak had not yet commenced for this year. In addition to the need for more exact isolation and identification of the "diarrhœa microbe," it was of equal importance to study how this and other bacteria acted in producing disease, whether it was probable by the production of some poisonous material of an alkaloidal character, such as ptomaines or leucomaines. These inquiries were of supreme importance to physician and clinical observer as well as hygienist, but could hardly be expected to be carried on by an ordinary health officer, with multifarious routine duties to attend to. Such questions as these required the whole time and attention of specialists.

INFECTIVITY OF PHTHISICAL SWEAT.—Mattsis' experiments have led him to the conclusion that (*a*) the sweat of phthisical patients contains the bacillus tuberculosis, and is therefore infectious; (*b*) that these bacilli are not eliminated from the body through the perspiration, but come from the sputum, are suspended in the air and became attached to the linen of the patient. The sweat of tuberculosis was first investigated by Severi in 1884, who discovered the bacillus of Koch in the excretion.

MISCELLANEOUS.

MINERAL FIBERS.*—Mr. C. V. Boys, describing in the Physical Society in London "The Production, Preparation and Properties of the Finest Fibers," said that in producing very fine glass fibers, he found it best to use very small quantities at high temperatures with a velocity of separation as great as possible. In the last point the best results are given by a cross-bow and straw arrow, to the tail of

* Popular Science Monthly.

which a thin rod of the substance to be drawn is cemented. By this means, fibers of glass less than $\frac{1}{100000}$ of an inch in diameter can be made. The author had also experimented on many minerals with more or less success. Ruby, sapphire and fleur-spar could not well be drawn into fibers; but quartz, angite and feldspar gave very satisfactory results. Garnet, when treated at low temperatures, yielded fibers exhibiting the most beautiful colors. From quartz fibers less than $\frac{1}{1000000}$ of an inch in diameter had been obtained. The thread cannot be drawn directly from the crystal, but the latter has to be slowly heated, fused, and cast in a thin rod. Quartz fiber seems to be free from the torsional fatigue so evident in glass and metallic fibers, and is therefore valuable for instruments requiring torsional control. The tenacity of such fibers is about fifty tons on the square inch.

IGNORANCE IN MEDICAL MICROSCOPY.*—There is strict truth in the remarks of Dr. James Tyson in a paper on the "Relation of Albuminaria to Life Insurance," when he says: "I have known men with good medical education say that casts were present in a given specimen, when there were none; certain granular aggregations having been mistaken for them." And again: "Take, for example, so simple a matter as examining for tube casts, which may be regarded as almost the easiest sort of microscopical work, yet how few medical examiners are competent to make such examinations. Most of them have no microscopes, and many who have them use them so rarely that their opinion, whether positive or negative as to the presence of casts, cannot be relied upon."

NEWS AND NOTES.

THE UNITED STATES commission for the investigation of hog cholera, consisting of Profs. Shakespeare, Burrill and Dr. Bollton, have gone to South Carolina to continue their labors.

"THE STRANGE MARKINGS ON MARS" is the title of an illustrated article to appear in the May *Popular Science Monthly.* The author, Mr. Garrett P. Serviss, tells how these markings have been explained, and shows the bearing of what is known about this planet upon the question whether or not it is the abode of life.

MR. PHILIP HENRY GOSSE, the distinguished English naturalist who died on the 23d of last August, was born at Worcester, April 6,

*Phila. Medical News, November 17, 1887.

1810. For some years he resided in Newfoundland and Lower Canada, being engaged in mercantile and later in farming pursuits. In 1838 he resided in Alabama for six months, returning to England in 1839, and in 1844 visited Jamaica for the purpose of studying the natural history of that island. From 1852 to the time of his death he was a resident of St. Marychurch, Devonshire. Mr. Gosse was a voluminous writer, having published, according to a writer in the *Canadian Entomologist*, about forty books, and upwards of fifty papers in the proceedings of the Royal Society. "For some years," says Mr. Thos. W. Fyles in the journal cited, "he was engaged in preparing works for the S. P. C. K.. After that he devoted himself to the study of the British Rotifera. In 1856 he was elected a Fellow of the Royal Society. He was an indefatigable worker, usually in his study by four o'clock in the summer, and by six o'clock in the winter, and produced on the average two works in the year." Mr. Gosse was, perhaps, best known to Americans from his work, in connection with Mr. Hudson in the Rotifera, and his "Evenings at the Microscope."

BOOK REVIEWS.

MERCK'S INDEX OF FINE CHEMICALS AND DRUGS FOR THE MATERIA MEDICA AND THE ARTS. E. Merck, Darmstadt, Germany. New York: 73 William Street.

This is the first American edition issued by this well-known chemist, and comprises "a summary of whatever chemical products are to-day adjudged as being useful in either medicine or technology." This index will be found useful not only to chemists and physicians, but to all who make use of chemicals and reagents to any extent.

A HEALTHY BODY. A text-book on Anatomy, Physiology, Hygiene, Alcohol and Narcotics. By Charles H. Stowell, M. D., Professor of Histology and Microscopy, University of Michigan. Cloth, pp. 7-215. John C. Buckbee & Co., Chicago.

This little work is intended for use in intermediate grades in public and private schools, and relates in a simple and clear manner the more important facts in physiology. The illustrations—original with the author—are in keeping with the text, and, being largely diagrammatic, cannot fail to elucidate that which might seem obscure. The author has seen fit to give particular attention to the effects of alcohol and tobacco on the system; and although he states in the preface that "in this respect no statement has been made that is not capable of positive proof," we think that, as applied by him, they could not be proven. Extreme and rare effects of the poisons are made to appear as a necessary concomitant of even moderate indul-

gence. What effect such an exposition will have on the minds of the young we do not know. If it serve the purpose well it may be justifiable.

COLLEGE BOTANY. By Prof. Edson S. Bastin. Including Organography, Vegetable Histology, Vegetable Physiology, and Vegetable Taxonomy, with a brief account of the succession of plants in geologic time, and a glossary of botanical terms. Being a revised and enlarged edition of the "Elements of Botany," with nearly six hundred illustrations, largely from drawings by the author. Pp. 451. Chicago: G. P. Engelhard & Co.

It is but a little more than a year ago since we reviewed Prof. Bastin's excellent "Elements," which is now expanded into the more pretentious volume before us, under a new title. The present work is, however, the old one only in foundation, most of the parts having been largely re-written and much new matter added. That portion devoted to vegetable histology is particularly well done, and cannot, with its clear and simple descriptions and numerous well-executed cuts, but be of great service to the beginner in this department of botany. We are glad to note that the appendix devoted to the use of the microscope, micro-reagents, etc., has been largely augmented by the addition of new matter, so that it now embraces all that the beginner need know in micro-botanical technology. In the first three parts of the book practical exercises are introduced at the end of each chapter, so that the student may actually work out for himself what he has read in the text and seen in the illustrations. The handling of these exercises is admirable, and the student without a teacher will be able, by their aid, to familiarize himself most thoroughly with the different elements which go to make up vegetable bodies.

Prof. Bastin strongly emphasizes the fact that, while photographs of sections undoubtedly serve an excellent purpose, they can in no way replace the drawing which the student makes with his own hand. "The student," he says, "who practices it will see more with his microscope than one who does not, and he will also reach sounder conclusions regarding what he sees."

Taking Prof. Bastin's book as a whole, we believe it to be the best text-book of botany for schools and colleges yet published.

CORRESPONDENCE AND QUERIES.

CHARLES FASOLDT, SR'S., RULINGS.

BY FREDERICK NEUDORF, JR., PH. G.

Having listened to many discussions and read much about Mr. Charles Fasoldt, Sr's., rulings, my curiosity was aroused, so one

evening Mr. H. J. Grose, druggist, and I called at Mr. Fasoldt's place of business and requested an exhibition of his handiwork.

He received us kindly, and very interestingly entertained us for over two hours.

The rulings were shown through the microscope with the aid of Mr. Fasoldt's new "Vertical Illuminator."

The plates were ruled in bands with lines alternately longer and shorter, beginning with 5,000 lines to the inch and increasing in each band up to 30,000; after that 10,000 in each band up to 250,000. Our examination commenced with the band of 90,000. In the band of 100,000 Mr. Grose and I counted every line on the ends and compared them with the U. S. standard of measurement, using a micrometer which is composed of three very delicate steel prongs, arranged thus $_{\mid}{}^{\mid}{}_{\mid}$.

The first lower prong was placed stationary over the first line of the band of 100,000, the upper prong over the second line, the next lower prong over the third line, and again the upper prong over the fourth line, and then alternately moving the two latter prongs until the upper one was placed directly over the 50th line of the band ruled 100,000 lines to the inch, every line of which we saw distinctly.

The distance between those 50 lines represented $\frac{1}{2000}$ part of an inch.

Mr. Fasoldt commenced his exhibition where scientists have heretofore been supposed to discontinue their labors.

This test-plate was then removed from the stage and a micrometer (U. S. standard) placed thereon, the prongs of the micrometer heretofore used remaining as stationed in the eye-piece. The lines of the U. S. Standard, 2,000 to the inch, were brought into focus. The space between two of these lines corresponded exactly with the space between two of the prongs, thereby proving the truthfulness of Mr. Charles Fasoldt, Sr's., claims and the accuracy of his rulings.

We then proceeded with the finer rulings, satisfying ourselves of their accuracy, until the 230,000 band was brought into focus. We saw the lines, but not distinct enough to be resolved.

Several evenings afterwards Mr. Grose and I called again to convince ourselves that we had actually seen what we claimed. Mr. Grose said that he resolved the 220,000 band, but not as clearly as on the first evening; but on the contrary I saw the lines and space between the lines and resolved them in the 220,000 band. In the 230,000 band I saw the lines, but not sufficiently distinct to say that I resolved them.

I also looked at the same rulings with the aid of an Abbè condensor, but I could not resolve any lines in bands containing more than 200,000 lines to the inch.

Signed by FREDERICK NEUDORF, JR.,

WM. HEADLAM, JR., Witness. H. J. GROSE.

HAWK'S PARK, Fla., April 13, 1889.

EDITOR MICROSCOPE:

I wish to add a small tribute to the memory of Henry Mills, the notice of whose death appears in the March number of your journal.

I never had the pleasure of meeting Mr. Mills face to face, but have had more or less correspondence with him for several years past, and I am one of those who have received many benefits by his kind words, and can fully appreciate all that was written of him by Prof. Kellicott.

Mr. Mills wrote me in January of his intention to come to Florida this winter, and expressed a desire to visit me at my home, but the anticipations of the pleasure of his company were not realized, for my letter in reply was never seen by him. In a few days after I received a letter from his daughter, Mrs. R. B. Richardson, informing me that her father had gone to " a brighter world, a a place more congenial than the sunny South."

Accompanying Mr. Mills' last letter to me was a vial of diatoms, which I have no doubt was one of the last, if not the last, specimen ever sent out by him. E. S. CONTANT.

10. (ANS.)—Glycerin jelly is best for mounting stained wood sections. Anything to be mounted in balsam must be dehydrated; this shrinks the protoplasm and leaves the section mummyfied. Glycerin jelly preserves the protoplasm and differentiates structure perfectly. It preserves colors better than balsam.

J. D. K.

I have used balsam, glycerin jelly and glycerin for mounting both stained and unstained wood sections. The balsam mounts bring out detail that I fail to find in either of the others. This is especially true of the stained sections, and I find that it will do to stain the tissues much deeper for balsam than for glycerin or glycerin jelly. A ring of gold size around the balsam mount will prevent it from becoming so dry and brittle that the cover glass will crack off. Such a protection also has a tendency to prevent the balsam from turning yellow, as we sometimes see it do in very old mounts. W. M. WHELPLEY.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS *who have microscopical apparatus, material or books which they wish to exchange, and such wants will be* INSERTED FREE OF CHARGE. *The number of insertions given will depend upon the number of exchanges received each month. Subscribers will please notify us when articles have been exchanged or sold. Dealers are referred to our advertising department.*

WANTED—THE MICROSCOPE, Vol. I to VI inclusive.
W. E. SWIGERT, Spencer, Owen Co., Ind.

WANTED—Several good objectives and eye-pieces; must be in first-class condition. State full particulars. Also want unmounted material. Will exchange or buy. Correspondence invited. CHAS. VON EIFF, 20 Palmetto St., Brooklyn, N. Y.

WANTED.—Vol. VI, No. 1.
LANCET & CLINIC, 199 W. 7th St., Cincinnati, Ohio.

FOR SALE—Vols. IV, V, VI, VII, of THE MICROSCOPE, bound in two volumes; quarto edition of Wyett's "The Microscopist;" Marsti's "Section Cutting," and Phin's "How to Use the Microscope." For cash only.
H. M. RICHARDS, 27 Ellery St., Cambridge, Mass.

WANTED—Histological and pathological material to cut on the halves. Nothing but first-class material desired. Address C. B. CLAPP, M. D., Danville, Ill.

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ORIGINAL COMMUNICATIONS.

INFLUENCE OF MICRO-ORGANISMS IN CARIES OF THE TEETH. *

F. O. JACOBS, D. D. S.

I HAVE seen recently in THE MICROSCOPE, a reference to a paper, by Dr. W. D. Miller, of Berlin, in which he advocates the theory that micro-organisms are to a large extent the cause of caries of the teeth.

The writer seemed to indorse his (Miller's) views.

I have seen Dr. Miller's paper on the subject, and think some of his statements rather remarkable. I thought it no harm to bring the subject before the society. I did not think his reasons for holding such an opinion sufficiently convincing; I do not dispute but that various species of bacteria may and do produce disease, but in many cases they are merely the accidental accompaniment of disease. I think caries of the teeth is one. As to their being able to cause decay of a tissue containing such an excess of inorganic matter as the teeth, especially in the way he points out, is hardly probable.

I was inclined to class his discovery along with many others that have come to us from beyond the sea; such as fossil organisms in meteorites, the reticulum, homœopathy, mesmerism, phrenology, etc. I would not have you think that I am of the opinion that all real discoveries, everything that is genuine, must have originated in my own country. I recognize the fact that many of our greatest

*Read before the Ohio State Microscopical Society, November 22, 1888.

scientists, especially pathologists, chemists, etc., are to be found on the other side. I have not forgotten Virchow, Heckel and many others whose names might be mentioned. But it is a curious fact that from Germany comes at the same time some of our greatest discoveries and greatest humbugs in science. It has been truly said: "Superstition forever lurks about the camp fires of science." And it really seems, too, that often we seize an idea more because it is novel than because of any substantial proof in its favor.

My objections to the germ theory of caries are the following: 1st. The earthy material is dissolved out long before the organic portion of the tooth is broken down. A microscopic examination of a tooth, with even a low powered objective, will show this to be the case. Whereas an organism operating upon the tooth would destroy the organic portion of the tooth first; and removal of the lime salts would be merely incidental, and the diseased portion of the tooth would lose all structure. This, however, is not the case until long after the inorganic part is gone. 2d. It is not likely that an organism so simple in its organization as bacteria could subsist and reproduce itself so rapidly as they, and still have force enough left to perform a work requiring so much energy as the destruction of tissue like the teeth is composed of, the hardest in the body, and that would be of so little use to them. For they could not appropriate the earthy material, and the rest of the tissue would afford but little nourishment. 3d. An artificially decalcified tooth presents about the same appearance under the microscope as a carous one would. Like causes produce like effects.

Dr. Miller quotes from A. Weil, in saying that a specie of bacteria leptothoix bucalis bore directly through Nasmyth's membrane into the enamel. What for? It certainly seems strange that these minute and soft-bodied organisms, without organs of special function, so far as we know, could sink a shaft into a tissue like the enamel where there is only about from three to five per cent. organic matter. They could certainly do better on the outside. These organisms must subsist while doing their evil work; and the enamel is the hardest tissue of the body. But right here Miller goes on to say: "These organisms attack first the organic material, and feeding upon it create an acid which removes the lime-salts." It would seem that a large quantity of acid is generated from the small quantity of organic material contained in a tooth, about twenty-five per cent. at most. But unfortunately the "organic material" is the last to be destroyed. His statement is not borne out by an examination of the tooth. The statement of A. Weil, from whom he quotes, certainly

does not agree with his idea. Weil seems to think these organisms are created expressly to bore holes in the enamel of human teeth, and have no need of subsistence: a sort of biological perpetual motion.

Miller says: "The ordinary course of the disease is this: Enormous masses of fungi leptoterix threads, baccilli, micrococi, etc., work their way into the deeper parts of the softened dentine, stop up the dental tubuli, or destroy the dental fibrils ; the outer layers of dentine consequently receive no further nourishment, lose all vitality and fall a prey to putrefaction." Now you will observe that before "the ordinary course" begins the work has been accomplished. That is, the tissue has been softened, the lime-salts are gone. According to his own saying, there is already caries of the teeth.

After these leptothrix have penetrated so deep, the tissue must already have been destroyed.

Stopping up the dental tubuli can do no harm.

This is the method used by dentists to arrest decay. Cut off all communication with the outside and the more perfectly the work is done, the more effectually is the object accomplished.

That such organisms are found in cavities of carous teeth cannot be denied. But that they do or can have any considerable effect upon the normal tissues of the teeth in producing disease there is no evidence.

Here is one of Dr. Miller's experiments: He places a freshly extracted tooth in concentrated carbolic acid, and after the space of one hour finds it quivering with living organisms. This is certainly the work of his imagination. Who could expect (knowing the nature of carbolic acid) to find signs of life in any organism after having been drowned in carbolic acid. But Dr. Miller says he has seen motion, quivering. He should certainly know that it could not be on account of any form of life known on this planet. He thinks it showed that the fungi had penetrated to an extreme depth. Surely the "quivering" must be accounted for in some other way. Such statements seem to detract from the value of his conclusions.

Here is another discovery: "The leptothrix threads contain granules of starch." This conclusion is reached by the application of the same test as was used by Drs. Lieber and Rottenstine* (iodine and sulphuric acid) in their test for fungi, when their presence could not be satisfactorily determined without. But they do not claim it indicates the presence of starch; and botanists pretty gener-

* Lieber and Rottenstine on dental caries and its causes. Translated by T. H. Chandler, D. M. D.

ally agree that starch is not found in plants other than those containing chlorophyle, and that the presence of the latter, together with sunlight, is necessary for the manufacture of starch. What the starch-bearing fungus has to do with caries he does not say, but would it not have a great deal to do with the value of his conclusions generally ? It would certainly be a fine thing to discover granules of starch in these minute organisms, and if they were there, it would be for use of the plant, not to ferment an acid for cutting the teeth.

Dr. Miller thinks he has seen baccilli in the dental tubuli. What he has seen I am convinced is nothing more than the contents of the tubules shrunken by the reagents he used so as to break into nodules, which being stained might be mistaken for an organism of that kind.

This investigator says: "I have been able to obtain sufficiently thin sections of fresh dentine in an advanced stage of decomposition to observe and study the action of the fungi and see the tubules filled with micro-organisms in active motion." He must certainly be mistaken, for even if he succeeded in getting his sections without destroying all life, the liquids he would have to use to produce sufficient transparency would destroy the life of any specie of fungi. Besides a staining fluid would be necessary to show such organisms, and such as are used for staining bacteria are fatal to life. He describes but one method of preparing his specimens, which, while it is good enough for all ordinary purposes, its use would destroy the life of any species of bacteria.

It is the ordinary method of preparing such objects for the microscope. He passes them from alcohol to the staining fluid, then to the mounting medium. The very first step would kill. There are, I admit, cases on record of some very highly organized beings able to withstand large quantities of that liquid when taken internally, but when applied to the outside in any considerable quantity it is fatal. Might it not be that Dr. Miller has mistaken a glimmer that sometimes comes before the eyes on looking through the microscope, for living organisms?

He finally claims to have met with one kind of fungi, "which beyond all doubt, has the power of boring directly into sound dentine." He says, "it appears to generate an acid upon its growing extremity by means of which it eats its way into the hardest dentine." And what is more wonderful, it does not even follow the dental tubuli, but cuts across in any direction, preferring the most impossible method. This is a very remarkable discovery. It would be

interesting to know how he succeeds in observing these specimens alive, and in distinguishing a growing extremity from the extremity that does not grow. Transmitted light is necessary, even to see them at all, and the difficulty would be greater in case of such sections as these, for the earthy matter has not been dissolved out; therefore the preparations would not be as transparent as in the case of microtome sections. Besides, this fungi must certainly be a unicellular plant. In such a case it would grow in all parts alike, and not having organs of special function, one part would look like another. Nor is there a chance to divide an object so small into extremeties. It would be interesting to know in what respect it differed, one extremity from another. This is certainly a new specie, and Dr. Miller should have given us an accurate description of all its parts.

Another difficulty is the acid that is given off at the growing extremity. How could he determine it to be an acid, or see a flow of liquid from an object so small? He must have a good microscope.

I have examined a great many sections of teeth, from perfectly sound teeth to all stages of decay, but have never seen anything like microfungi in any part except the structureless material taken from the cavities of carous teeth. Of course this is only negative evidence, but there is a quantity of it.

A hard section of a tooth was placed in a bottle containing some distilled water and infected with decomposing organic matter. An examination was made from time to time. Bacteria at certain stages was found in abundance, but the tooth section remained unaffected; no micro-organisms were to be found within its tissue and the surface retained its polish. Even the small amount of organic matter it contained was no temptation to these desperadoes.

It is well known that after death decomposition soon sets in, in the soft parts, but the last to succumb to the action of the elements is the teeth. Then it is in the mouth only that the conditions exist favorable to decay. If bacteria or other organisms have anything to do with the process, why not do the work out of the mouth, especially when the conditions most favorable for their existence are arranged?

My conclusion is that caries of the teeth is entirely a chemical process.

The predisposing causes of caries are (1) inherited defects in the structure; such as flaws and extreme thinness in the enamel, especially on approximal surfaces and in the crevices of molars and bicuspids, where fluids are held by capillary attraction. (2) One other matter to be taken into consideration is the influence of impact

in developing the shape, proportions and structure of the teeth. Everyone knows that exercise is essential to a healthy or proper development of the muscles. No one doubts but that the strength of the arm of the blacksmith is due, to a large extent, to the exercise it receives. Few, however, stop to consider that upon a similar influence depends the character of a tissue like the teeth. E. D. Cope has pointed out the effect of "impact and strains on the feet of mammalia," in a paper read before the National Academy of Science. He says: "There is every reason to believe that shocks, if not too severe, encourage growth in the direction applied."

I fully indorse what he says there, and will add that such influence determines the character of the tissue in the parts so influenced. Apply this to the teeth. Note the size and strength of the incisors of the rodentia; the canine of carnivorous animals, also the rudimentary nature of their incisors. Now there can be no doubt but use is the cause of the excessive development in the first case and want of use the cause of the rudimentary condition of the latter. Now how does this apply in a pathological sense? It seems to me this will show the necessity of perfect articulation.

A tooth that is not opposed by another tooth must always be deficient in structure, and will always lack the proper quantity of earthy matter. In other words, it is soft and soon becomes affected with caries. It is a very unobserving dentist who has not noted that perfect articulation is essential to a healthy condition of the teeth. The reason is clear. The influence of "impact" has developed the structure and caused a proper deposit of earthy material where the articulation is perfect, so as to harden the tissues and thus increase their power of resistance to the action of acids.

This being the case, any abnormal condition that would prevent a perfect articulation is to be considered a predisposing cause of caries.

The active or immediate cause of caries is nothing more or less than the various acids either taken into the mouth as food, or with the food, or generated there. Most acids that find their way into the mouth are injurious to the teeth, such as fruit acids, vinegar, lactic acid, and acids may be generated in the mouth that will act upon the teeth; but whatever influence fungi may have in this, if any, would be indirect and comes from the decomposing food material, and not from the tissue of the teeth.

The saliva, which is generally alkaline, plays a part in softening and loosening the remaining organic material (which is, of course, dead after the acid has done its work), exposing fresh surfaces to the

action of acids. This makes the process somewhat alternate. First a dissolving out of the lime-salts, then loosening and breaking up of the organic material, etc.

At first the process is slow, but as advance is made, the cavity becoming larger, its capacity for holding liquids and decomposing particles of food is greater; the inner part of the tooth containing less and less earthy material, the process becomes more and more rapid until the pulp is reached, which, not being able to withstand the sudden changes of temperature it is now subjected to, soon dies.

CONCERNING THE DIFFERENTIATION OF BLACK PIGMENT IN THE LIVER, SPLEEN AND KIDNEYS, FROM COAL-DUST DEPOSITS.*

FREDERICK GAERTNER,

A. M., M. D., UNIVERSITY OF STRASSBURG, GERMANY; M. D., ST. LOUIS MED. COLLEGE; A. B., MOUND CITY COLLEGE, ST. LOUIS; CERTIFICATE ILLINOIS STATE BOARD OF HEALTH; CERTIFICATE OF ENDORSEMENT FROM UNIVERSITY OF PENNSYLVANIA; MEMBER IRON CITY MICROSCOPICAL SOCIETY AND OF THE AMERICAN SOCIETY OF MICROSCOPISTS; MEMBER GERMAN SOCIETY PHYSICIANS AND SURGEONS OF BERLIN; HON. MEMBER OF PHYSICIANS AND SURGEONS OF VIENNA; CORRESPONDING PHYSICIAN TO THE STRASSBURG PATHOLOGICAL SOCIETY, ETC., ETC.

KNAUFF asserts (Virchow's Archiv., Vol. XXXIX, page 442, 1867) that in animals confined in the smoke chamber for a time, the inhaled coal-dust had penetrated to the extremities of the breathing organs; further, that the pigment for the most part adhered to the cellular elements, but free pigment had also lodged in the alveoli. These cellular elements were partly free, partly more or less detached, or fixed to the walls. The filling of the cells with coal-dust was, as a rule, incomplete. The same formations were also found lodged in the parenchyma beneath the surface of the alveoli. A narrow but distinctly visible strip of colorless lung tissue separated the lumen of the alveoli from the stratum containing the coal. The black particles lay either scattered and seemingly without definite order, or formed more or less connected lines. The arrangement of the coal particles in ramifying lines appeared still more distinctly on the surface of the lungs. From these manifold branching lines, connecting chains proceeded, so that the whole presented the appearance of a vascular system. And thus the design of the injected lymphatic vessels was traced by the coal-deposit. When an animal had been exposed to

* Continued from page 131.

an atmosphere thickened with coal-dust, and the roots of the lungs were more closely examined immediately after death, the lymphatic canals appeared as gray lines, just as if India ink had been artificially injected. The liquid contents of the canals could be moved hither and thither by stroking and pressing, more easily, of course, towards the lymphatic glands than in the opposite direction, because of the opposition offered by the imperfect valvular apparatus.

On closer examination, the gray contents was found to consist of fine granules of coal, partly free, partly inclosed in the cells, of exactly the same appearance as that in the lung parenchyma. From the above experiments, the following was deduced: From the surface of the alveoli the coal-dust and soot force their way into the parenchyma of the lung; there it must be supposed there exists free communication, although the passages cannot be demonstrated.

But that these passages may be traced, was later shown by Klein. (Elements of Histology, third edition, 1884.) Between the flattened, transparent epithelium cells lining the alveoli are minute openings, "*stomata*," leading from the cavity of the air-cells into the lymph-lacunæ of the alveolar wall. These "*stomata*" are more distinct during expansion, *i e.*, inspiration, than in the collapsed state. Inspiration, by its expanding the lungs, and consequently also the lymphatics, greatly favors absorption. Through these "*stomata*," and also through the interstitial cement substance of the lining epithelium, may penetrate particles, such as soot from a smoky atmosphere,pigment artificially inhaled, cellular elements, such as mucous or pus corpuscles, and even germs that have been carried into the alveoli from the bronchi by natural inspiration. They may then pass into the lymphatic vascular system, close to its finest roots (the lymph-canaliculi of Recklinghausen), which, of course, cannot be represented. From here they pass into the lymphatic vascular capillaries, and are gathered particularly where several lung alveoli meet, chiefly at the point of transmission of the infundibula into the alveolar passages. Just here the dust particles accumulate. The lymphatic vascular systems mingle in the sub-pleural, but especially in the peri-bronchial and peri-vascular tissues; and through their channels the dust particles move, and are carried into the bronchial and tracheal-lymphatic glands, and there deposited.

As Slavjansky proved (Virchow's Archiv., Vol. XLVIII, page 326), lymphoid cells appeared in the lung alveoli after experimental inhalations of dust, in which especially cinnabar, also ultramarine, indigo and coal dust were used, or with animals compelled to remain for a considerable time in a dust-laden atmosphere. These

lymphoid cells, also the lung-epithelia and particles of mucous, were laden with the inhaled dust; moreover, free dust was found in the lumen of the alveoli as well as in that of the bronchiæ. On the other hand, the cylindrical-epithelial cells of the bronchiæ were entirely free from dust. Further, Slavjansky pointed out, in rabbits, three days having elapsed after the inhalation of cinnabar, cells containing coloring materials in the cortical layers of the lymphatic glands situated at the base of the lung. From all these researches, it has been concluded that the dust (cinnabar, coal, etc.) inhaled under artificial or natural conditions, is driven into the distant extremities of the breathing canals, there received by the cellular elements, lymphoid and mucous cells, perhaps also by the flat and transparent epithelium which, lining the alveoli and these cells, are then either absorbed by the lymph-canaliculi, or are conveyed into the lymphatic vessels. (Klein.) From the small lymph-canaliculi they are led into the lymphatic vessels, and thence into the lymphatic glands situated at the base, and deposited.

Concerning the consequences of this depositation in the lymphatic glands, Roth writes in the "*Correspondenzblatt für die Schweizer Aerzte*," Jahrgang XIV, 1884, as follows: "The changes vary according to the degree of coloration of the lymphatic glands; if it is but trifling, it may be endured without further disturbances; but if considerable, local inflammation, lymph-adenitis and peri-lymph-adenitis chronica may set in. In consequence of the latter, on the one hand, a development of cicatricial tissue, a common slaty induration of the tracheal and bronchial lymphatic glands, and further, a shrivelling and a destruction of the lymphatic structure, may result; on the other hand, the process may become acute, and soon abscesses of the lymphatic glands, with suppuration of the capsule and the neighboring tissue, may result. The process may also spread to the neighboring organs, as the bronchiæ, veins, arteries, heart or pericardium, which may lead to fatal results. Or the former slaty, indurated mass may soften, slough and become a slaty pulp, which microscopically and chemically presents nothing else than anthracotic pigment in a free state, or deposited in lymphoid cells; also cells of fatty degeneration, cholesterinic clots of necrotic tissue, at times also leucin and tyrosin, occasionally even lime. To the united product one might, in my opinion, give the name "slaty cheese."

Should the process take a chronic course, it is not seldom found in dissecting that the more or less enlarged, slaty, indurated lymphatic glands, on being cut into, present a striped appear-

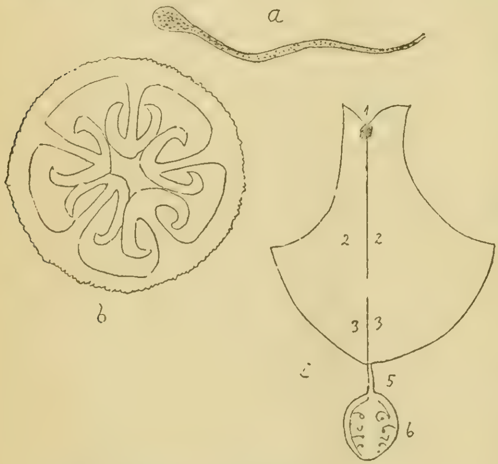
ance, obviously a product of the chronic inflammation of the gland's tissue. The most varied local changes result from prolonged local inflammation of the lymphatic glands. In regard to this, Weigert has already declared that very soon inflammatory adhesions with the bronchiæ at the hilus, arteries, veins, nerves and lymphatic vessels will occur, and at times also with the vena cava inf. and sup., and occasionally even with the vena azygos dextra.

(TO BE CONTINUED.)

OBSERVATIONS ON THE FERTILIZATION OF THE PHANEROGAMS.

JOHN KRUTTSCHNITT.

NOTWITHSTANDING the unfavorable reception of my former remarks on the pollen-tube question by certain professors of botany in the United States and in Europe, I am induced again to place the result of my more recent investigations before the public.



a. Conducting tissue, (natural size).
b. Ovary, transection, x 50.
c. 1, stigma; 3, segment of the testis; 3, path of the conducting tissue; 5. style; 6, ovary, natural size.

The advocates of the process of fertilization of the vegetable ovules by means of pollen-tubes select frequently an Orchidaceæ for its demonstration. The simple examination of a transverse section of an orchis, it seems to me, should be sufficient to demonstrate the impossibility of a tube, supposed to contain at its apex the generative and vegetative nuclei, emitted by the pollen on the stigma of a number of plants, to penetrate into the ovary in search of the micropyle, and the oosphere in the embryo sac. If this example be not sufficient, the study of the anatomy of *Sarracenia flava* should certainly carry conviction to any unbiased mind.

Let us follow the path a pollen-tube would have to travel before it could reach the ovary. The pistil, in this instance, is a large, umbrella-shaped membrane, bearing the stigma in the angles formed

by its five segments. (b represents one of the segments, natural size.) The stigma is a bundle of papillæ, and is placed, as mentioned above, in the recess formed by the segments at their point of meeting. The conducting tissue runs down from the stigma along the ribs of the pistil. Its five branches meet at the apex of the style surmounting the ovary. The conducting tissue is easily separated from the pistil (b), and under the microscope presents a finely-fibrillated tissue, bearing numberless granules and blotches of the contents of the pollen taken up by the stigma. The anthers are hypogynous and numerous. The conducting tissue is coexisting with the other organs of a plant. It is developing along with them, and is found everywhere it has hereafter to perform an office. Prior to the maturity of the anther, which is reached at quite an early period of plant life, and before the pollen has been deposited on the stigma, the conducting tissue presents also a fibrillated appearance, minus the granules, which appear only after the pollen has been deposited on the stigma. The five branches of the conducting tissue unite at the apex of the style, and after having been charged on the stigma with the fertilizing element of the pollen, descend through the style into the interior of the ovary, fertilizing it as a whole. The anatropous ovules are brought by their micropyle in contact with the placentæ. The fertilizing fluid contained therein is taken up by the papilla around the micropyle, and thereby brought in contact with the oosphere in the embryo sac. Fertilization is now accomplished.

The advocates of the pollen-tube theory maintain that the pollen-tubes, which, after the pollen has come in contact with the viscid matter on the stigma, are emitted sometimes, carry on their apex, as already mentioned above, a vegetative and a generative nucleus. These tubes are supposed to vegetate and lengthen in the midst of the connecting tissue as they are progressing in their route towards the micropyle and the oosphere in the embryo sac; therefore, in the present instance, the pollen-tube would have to travel from the stigma along the ribs of the five segments of the minute style at the apex of the ovary. Here the first difficulty would present itself. The style is only about $\frac{1}{22}$ inch in diameter; each ovule must be accorded a separate tube; the descent through the tissues of the style of more than one or two is an impossibility. Should this difficulty, however, have been overcome, another and still greater one presents itself in the cavity of ovary. (c.) Here the placentæ are parietal; the ovules are anatropous, the micropyle is in close contact with the tissues of the

placenta, and having found at last the micropyle, it has to reach the embryo sac to accomplish there, in contact with the öosphere the act of copulation.

Mr. Strassburger, in his book published in Jena in 1884, entitled "Neue Untersuchungen über den Befruchtungsvorgang bei den Phanerogamer" (New Investigations concerning the Fertilization of the Phanerogams), makes on this subject the following remarks. I translate:

"The act of copulation is initiated by the two cell nuclei becoming flattened by coming in contact with each other, remaining, however, separated by their cell walls. These double cell walls become now indistinct, and finally disappear completely, so that the two cell walls merge into one. Each of the nuclear threads (Kernfaden) forms a framework, and is thus brought into immediate contact with the other. They do not penetrate each other, but only come in contact. A mixing of the substance of both nuclear threads does not take place: only their framework come in contact, without actually fusing together. An actual mixture only takes place between the fluid portion of the nuclei (Kernsaft) and eventually of the nucleoli. The morphologically differentiated elements of the nuclei do not permeate each other: this is only the case with the undifferentiated elements."

If I understand aright the foregoing remarks, it seems to me the process of fertilization as outlined by Mr. Strassburger, is about the same as indicated by me. I claim that the fertilizing fluid contained in the pollen is taken up by the conducting tissue, permeates the same in all its ramifications down to the micropyle of the ovules, while Mr. Strassburger and his followers make the conducting tissue the roadbed on which the pollen-tubes have to travel to their final destination.

NEW ORLEANS.

MR. GEORGE M. BERINGER, examining a sample of ground flax-seed, found that it was adulterated with corn meal to the extent of about forty per cent. "The adulteration of ground flax-seed with such material is," he says, "likely quite common, and may be easily detected by the test for starch. It is a well known fact that, although flax-seed may contain starch while growing, in the fully-matured seed the starch is entirely converted into albumen and oil. The writer suggests that the Pharmacopœia should require flax-seed to give with iodine no reaction for starch."

CHARLES FASOLDT.

W. P. M.

CHARLES FASOLDT, the well known maker of clocks and scientific apparatus, died at his home in Albany, N. Y., May 13th, aged 70 years. His death, though not unexpected by his immediate friends, will be a surprise and sorrow to a large number who have known Mr. Fasoldt through his scientific work.

Born in Dresden, Saxony, February 23rd, 1819, he continued a resident of that city until the completion of his apprenticeship, when he entered the Saxon army. From 1839 to 1848 young Fasoldt laid aside his mechanical pursuits and led the life of a soldier, serving the last three years of that period as an officer in the "Allgemeine Volksbewaffenung." At one time during the rebellion he conceived a plan of cutting off all communication with the forti fication Kœnigstein, and was put in command of the troops detailed to carry out his project. This, together with other exploits, made him a marked individual in the eyes of the Government, and, find ing that his further sojourn in the fatherland would be somewhat perilous to his personal liberty, at the close of the uprising he made his way through the Prussian lines and, via Bremen, escaped to America. Fasoldt afterwards learned that he, together with a number of his former companions, including Burgomeister Meier, Röckel and Pogonini, who were captured, had been condemned to be shot. This sentence was subsequently commuted to imprisonment for twenty years.

Fasoldt's intentions on arriving in America were to proceed to the, then, far west and to establish himself in some promising frontier town. His purpose, however, was never effected, for, on arriving at Rome, N. Y., where he had a brother living, the cold November weather and the inconveniences of traveling caused him to abandon the idea of going west and determined his settling for the time in a more congenial location. During that winter he, together with two assistants, were occupied in preparing the tools and machinery necessary for the manufacture of clocks and watches, and in the following spring he turned out the first eight-day watch, for Gen. Armstrong. Mr. Fasoldt's subsequent productions in this line were often exhibited at the fairs held by the Mechanics' Associations of Syracuse and Utica, and never failed to win for him the highest praise and awards. A detailed list of the products of Mr. Fasoldt's inventive genius during the remainder of a very active life would

occupy much more than the limited space at our command. The various tower clocks of his construction, with and without the automatic illuminating apparatus, the odometer, the current metre, his improvements in the construction of type-writers, and many other inventions, are existing monuments of his mechanical skill and versatility.

To microscopists Mr. Fasoldt was best known from his ingenious detaching nosepiece, and the remarkable micrometer rulings, which have provoked no little discussion among scientists. This work was taken up after several years of almost total abstinence from all exacting watchwork, which Mr. Fasoldt was obliged to relinquish on account of the failure of his eyesight, the result of a cold. In 1878, however, his eyes were completely restored to their normal condition and he set about constructing a machine for ruling on glass with a diamond. So great was his success in this that he finally succeeded in producing scales ruled a million lines to the inch.

In 1861 Mr. Fasoldt removed to Albany, where the remainder of his life was spent.

As a man, Mr. Fasoldt was full of life and enthusiasm. Being well informed on all subjects his mind was a sort of storehouse from which his friends were accustomed to draw information, his large experience and genial nature making him the most agreeable of companions. During the last few years of his life he devoted much time to the microscope and was never tired of exhibiting the powers of that wonderful instrument.

CHAS. FASOLDT.

WM. A. ROGERS.

MICROSCOPISTS will hear of the death of Mr. Fasoldt with unfeigned regret. The work which he has done in fine rulings and in micrometry entitles him to a better recognition than he has received. While there may be a difference of opinion in regard to his skill in the production of test plates, as compared with Nobert, it must, I think, be admitted that he has made some plates which are quite as good as the best of Nobert's. When it is remembered that he must have been more than fifty years of age before he took up the problem of micrometric rulings, and that he had had no previous knowledge of the subject, his success has certainly been most remarkable.

Two circumstances have acted as a hindrance to the recognition

to which he is really entitled. Both of these circumstances have affected his reputation abroad somewhat unfavorably.

The first is the very large claims in regard to his work, put forth for Mr. Fasoldt by some of his friends, and, to a certain extent, it must be admitted, by Mr. Fasoldt himself. The second is a rugged and somewhat unusual style in his public communications. The latter must be charged wholly to the fact of his inability to convert into felicitous English an essentially German style of speech.

Mr. Fasoldt was a mechanician of rare skill, and he had that element of character which is almost always found associated with real genius—supreme confidence in his own work. This striking trait of his character was of real advantage to him since it led him to answer criticism by doing better work in new ways. The improvement in his micrometers is especially noticeable. At one time he claimed that his micrometers had no measurable errors. This was simply an expression of faith in his own work at that time. With more experience he found that he had been too sanguine, and so he set for himself the problem of finding the best way to overcome these errors. It will be admitted by all who have used his micrometers, especially those made within the last five years, that his success in this direction has been remarkable. The fact that Mr. Fasoldt, at one time, thought he had reached a degree of perfection greater than is in reality possible, ought not to be remembered against him. He is not the only person who has had, at different times, too great a degree of confidence in his own work, as the writer can testify from personal experience.

Mr. Fasoldt maintained great secrecy in regard to his methods of ruling. The writer believes that the secret of his success consisted wholly in his skill in the preparation of his ruling diamonds. There is some evidence, derived from measurements of his rulings, that he did not use a screw. According to my own experience, there is no difficulty whatever in making the mechanical subdivisions of the ruled spaces far beyond the ability of the ruling diamond to cut a clean line which has a width less than the interlinear space. But whatever method Mr. Fasoldt may have employed, the results which he obtained must always command the admiration of microscopists, and the service which he has rendered in micrometry deserves grateful recognition.

WATERVIEW, ME., May 19.

FRAENKEL AND PFEIFFER, of Berlin, are publishing an atlas of bacteriology, in parts.

PROCEEDINGS OF SOCIETIES.

SAN FRANCISCO MICROSCOPICAL SOCIETY.

THE regular meeting of this society was held at its rooms, 120 Sutter street, April 24, 1889, President Payzan presiding. A fine series of photographs was exhibited, containing some graphic enlargements on the new Eastman bromide paper. This process of enlarging on bromide paper, though quite recent, is very popular and produces excellent results, the effect, when exposure and negatives are properly manipulated, being almost equal to steel engraving.

Examples were shown of Pleurosigma Angulatum, the negatives of which were taken at a magnification of sixteen-hundred diameters.

The bromide process commends itself to those interested in photomicography by its simplicity compared with the tedious work of printing from silver paper. The donations to the library included a very satisfactory *résumé* of the progress of microscopical investigation both at home and abroad.

Mr. Lickenby occupied most of the evening in concluding his practical demonstration of preparing and mounting insects in balsam. A general summary of his methods was given in the report of April 10th, but some special points were brought out at this meeting which are of interest to those engaged in this branch of the study. It is quite difficult in preparing many of the smaller forms of insects to remove the debris from the surface of the specimen without injuring the delicate portions. This the gentleman accomplishes by the aid of albumen, flowing the white of an egg over the object and immersing the slide in hot water till the albumen is coagulated, when it will generally crack open and may be removed in two portions, carrying with it all the foreign matter and leaving the surface of the specimen perfectly clean. Another thing strongly advocated is thorough washing of the objects in running water and a final rinsing in either filtered or distilled water before placing in alcohol.

In mounting, the insect is placed under the cover glass arranged in proper shape, the clearing solution applied, and, when sufficiently transparent, the oil of cloves is drained away and Canada balsam introduced at one edge of the cover-glass, the slide being held over the flame of a lamp to gently warm the balsam and allow it to flow in and displace the remaining oil of cloves. No annoyance need be felt at the presence of bubbles of air, as they will all gradually disappear. The mount, when filled with balsam, is placed in a warm

oven or incubator and kept at a temperature of from 120° to 130° Fahrenheit for twenty-four hours, when the balsam will be thoroughly hardened and all the air-bubbles driven out.

Mr. Lickenby does not advocate the use of volatile solvents with balsam, he being convinced that a certain amount of gas is always retained in the mount in a latent state, requiring only a slight amount of heat to produce bubbles and disfigure the specimen. The outer skeleton of insects is composed of a substance called *chitine*, which is quite unique in its chemical composition. It appears to be, within certain limits, very resistant to acids and alkalis, and it is owing to this fact that caustic potash can be used in such varying proportions in treating them for microscopical study. It is said, however, that *chitine* succumbs to the action of chlorine compounds, which would render that substance unfit for use in bleaching many of the delicate forms.

The members of the society are strongly in favor of these practical demonstrations, and quite a discussion of the matter was indulged in, the result of which may be the inauguration of a movement that will tend greatly to arouse the zeal and add to the effectiveness of future microscopic work.

Before adjourning, the society tendered Mr. Lickenby a hearty vote of thanks for his skilful and instructive demonstrations.

At the regular meeting, held May 8th, 1889, the visitors present were A. W. Craig and W. E. Bainbridge. The latter gentleman gave a good description and exhibited samples of a remarkable find located by him in Ventura county, near the head of the Sespe river. It consists of what is called "gem sand," which, when examined with a power of about fifty diameters, is seen to consist largely of garnets, zirconite and what parties to whom the material was submitted in the Eastern States pronounced to be diamonds.

The gems, to be sure, are small, appearing only the size of a rape seed when magnified fifty diameters; but where there is much smoke there must be some fire, and the presence of such quantities of minute stones surely indicates the existence of larger members of the same family.

Mr. Bainbridge remarked that he had no doubt thrown away numbers of the larger stones, thinking them loose quartz crystals, as he was only panning out the sand to find gold or large garnets.

Professor Hanks stated that the small stones said to be diamonds had all the characteristics of the California diamond, and his opinion is worthy of attention, as he has made a close study of the gem.

The metal platinum is also present in this sand, but whether in quantity sufficient to make it of commercial importance has not yet been ascertained.

The zirconite occurs in square prisms with pyramidal terminations, and the stones are of a light-brown color and very transparent. Altogether, the discovery of Mr. Brainbridge is a remarkable one, and its future investigation will be watched with great interest. It might be mentioned that the sand, of which samples were shown last evening, extends over a space of one-half to three-quarters of a mile wide by several miles in length.

Mr. Wickson exhibited a peculiar entomological phenomenon—the common aphis attacked by the "Fly cholera"; or, *Empusa muscæ*. The gentleman explained how the fungus spores lodge on or become attached to the body of a fly, immediately commence growing and penetrate through the skin. Once inside, the spore rapidly increases by self-division, in the manner of yeast cells. The first stages of the disease is indicated by the restlessness of the attacked flies; they soon, however, become weak and slow in their motions. Having securely fastened themselves with their broad tongues to the object upon which they happened to be when attacked by the last stages of the disease, a succession of spasmodic tremors pass through their wings and legs and they stiffen themselves out to fly no more.

The abdomen of the victim of this disease, previously already swollen, becomes more and more distended, and a fatty, whitish substance pushes through the softer membranes between the chitinous rings or segments. Soon after a whitish halo of spores is formed around the dead body, readily seen if the fly happens to have fastened to the glass of mirror or window-pane. These spores gradually cover the whole insect with a white dust, and they appear in ever-increasing numbers as the body of the victim dries up, until at last its whole interior is empty and only a shell remains. From an examination of the affected aphis, there appears no reason to doubt but what the fungus developed and ran its course the same as in the fly; their bodies being distended and surrounded with the white halo of filaments bearing ripe spores ready to be thrown off and carry on their work of inoculation.

It was suggested that here might be found a remedy for these annoying pests, by systematically inoculating *Aphis colonies* when existing epidemically, and Mr. Wickson stated that such a course had been spoken of, but could not say that it had ever been carried out. Unfortunately, the more destructive of the fruit and grain pests do not seem to be seriously attacked by this fungus, although

the chinch bug has an inveterate enemy in an allied fungus termed *Entomophthora*, which also carries off the larvæ of certain butterflies.

The donations to the library were current numbers of the monthly journal of the Royal Microscopical Society, and a copy of the annual report of the Alameda Board of Health, donated by Dr. Rhiel.

The Secretary read a communication from William Fred Stadtmuller, tendering his resignation, which was, on motion, accepted.

A number of samples of the Redondo beach diatomaceous earth has been forwarded to various kindred societies at home and abroad, and the Corresponding Secretary stated that a sample of the interesting jem sand would be sent to the Royal Microscopical Society.

C. P. BATES,
Recording Secretary.

IRON CITY MICROSCOPICAL SOCIETY.

AT THE last meeting of the Iron City Microscopical Society, held April 9th, the paper of the evening was by Prof. W. S. Jackman. His subject was "The Earth-Worm," illustrated with many large drawings and appropriate slides under ten microscopes. These showed sections of the spines, gizzard, nerve-cord, and the convolutions of the nephridia.

The other exhibits were: (1), sections of wild sage and bass-wood, W. J. Prentice; (2), blood of *Monopoma Allegheniensis* ("mud-devil" or "hell-bender") and man compared, J. B. Cherry; (3), various polariscopic objects, C. C. Mellor; (4), specimens of aluminium and bronze, J. H. Clapp.

On Friday evening, April 12th, the Society held its eighth annual soiree in old city hall, Pittsburgh, Pa. It consisted of an exhibition of microscopical objects under fifty microscopes, an entomological exhibit from the collection of Rev. Holland, Ph. D., and a number of specimens of the fine work of Prof. J. A. Brashear, including spectroscopes, polariscopes, latest celestial and spectrum photographs, and the celebrated diffraction gratings, ruled 14,420 lines to the inch. The soiree concluded with a lantern exhibition.

GORDON OGDEN.

MONS. M. E. BOUDIER has been elected President of the French Societé Mycologique.

EDITORIAL.

THE ORIGIN OF LIVING MATTER.

A CORRESPONDENT of THE MICROSCOPE writes, suggesting a new field of inquiry to be pursued by microscopists, as to the origin of life upon the earth. Reasoning from the fact that micro-organisms have been found in abundance in newly-fallen rain and snow, and therefore must exist floating in the atmosphere far above the surface of the earth, he advances the theory "that matter being known to fill all the interstellar space, it may be that life germs are an essential part of said matter, and are incessantly falling upon planetary bodies." A few of these germs falling upon the earth, when the conditions of heat and moisture were favorable for growth, developed, and from them have evolved the present flora and fauna.

As a possible means of determining the existence of organized bodies beyond the earth, our correspondent suggests that meteorites be examined for micro-organisms.

The theory advanced by our correspondent is without a doubt new to him, but it is essentially the same as the old hypothesis of Sir W. Thompson, which supposes that the germs of living things have been transported to our globe from some other.

While we grant that this hypothesis is unique, and may be satisfactory to some minds, we hold that in the light of modern biology it is not only an unnecessary theory of the origin of life on the earth, but a highly improbable one. The presence of minute organisms in the upper strata of the atmosphere proves nothing, as such organisms are undoubtedly of terrestrial origin. That meteorites can ever carry to the earth organized bodies, or even undecomposed organic matter, is impossible, inasmuch as the intense heat generated in them by their passage through the air would certainly destroy every vestige of it.

If the hypothesis of evolution is true, living matter must have arisen from not-living matter: for by the hypothesis, the condition of the globe was at one time such that living matter could not have existed in it, life being entirely incompatible with the gaseous state: and there is as much reason for supposing that all stellar and planetary components of the universe are, or have been, gaseous, as that the earth has passed through this stage. There is no necessity, then, for locating the abiogenesis that must have taken place at some remote epoch, beyond the earth.

The propounding of such an hypothesis shows how strongly

the fetters of dualistic philosophy bind the minds of scientific men, even of our day. The prevailing cosmology of our day, as did that of antiquity, assumes that the phenomena of organic life are explicable only by purposive causes, and that they in no way admit of a mechanical explanation; that is, one entirely based on natural science.

Although we know absolutely nothing of the causes which led to the origination of living matter, it must not be supposed that the differences between living and not-living matter are such as to justify the assumption that the forces at work in the one are different from those to be met with in the other. The teaching of modern biology is, that the phenomena of life are all dependent upon the working of the same physical and chemical forces as those which are active in the rest of the world. In this light, it is not difficult to imagine, in the remote ages when the condition of the earth's crust was such as to determine great activity in chemical combinations and decompositions, that the rearrangement and redistribution of atoms gradually became more and more complex, until finally, under some unusual combination of physical forces, carbon, hydrogen, oxygen and nitrogen united to form the wonderfully complex molecule of protoplasm.

To the consistent evolutionist, one minute particle of living matter thus formed is sufficient to account for the presence on the earth of all the organized bodies that exist or have existed. Any further independent formation of protoplasm would be sheer waste.

Whether or not science will ever solve the problem of the origin of life, can not now be known, but we do not think our correspondent has offered to microscopists a way to immortalize themselves.

THE second session of the Marine Biological Laboratory, located at Wood's Hall, Mass., will open June 3d, and continue to August 31st. Dr. C. O. Whitman, of the Lake Laboratory, will be the Director, assisted in the Investigator's Department by Howard Ayres, Ph. D., and E. G. Gardiner, Ph. D., and in the Student's Department by J. S. Kingsley, Sc. D., instructor in zoology; James E. Humphrey, S. B., instructor in botany, and Playfair McMarrich, Ph. D., instructor in microscopical technique. Circular and further information regarding the course may be obtained from the Secretary, Miss A. D. Phillips, 23 Marlborough street, Boston, Mass. Teachers of science residing inland should avail themselves of this opportunity to combine

instruction and study with recreation. A few weeks spent in this way will result in abundant fruitage for the winter months.

ACKNOWLEDGMENTS.—From E. D. Bondurant, Tuskalosa, Ala., mounts of normal human kidney and ovary; from Dr. John E. Hays, Sweet Springs, Mo., slide of *Bacillus tuberculosis;* from George B. Causey, Janesville, Wis., photomicrographs of scirus and fibroma mammæ.

ZOOLOGY.*

THE ANATOMY OF SALT-WATER SPONGES.†—Taking the *Halichondria panicea* as a familiar illustration, Hardy describes the anatomy. The surface is smooth, rising into low elevations, which are surmounted by crater-like openings. If the specimen is quite fresh and healthy, the existence of strong currents streaming out of these openings, or "oscula," may be demonstrated by placing a drop of carmine dissolved in sea water in the neighborhood of an osculum, when the up-streaming current will carry the color in, some of the particles being drawn to the surface of the sponge, others penetrating through microscopical apertures or pores, causing a distinct coloration. Under a lens the surface of the sponge is seen to consist of a thin membrane, "dermal membrane," supported by a reticulum of spicules, which, under a low power of the microscope, appears as a net-work of interlacing bundles of spicules embedded in a gelatinous substance, the sponge-flesh, and lie more or less parallel to the surface of the animal. The spicules of the rest of the sponge are also gathered into interlacing bundles, but lie in all planes. Each of these spicules, which may be straight or slightly curved, has the form of a delicate, elongated, double-pointed rod, which in section appears rounded, with its sides parallel throughout the greater part of their extent. The sponge-flesh will be seen to be pierced by the pores mentioned above. The oscula will be seen in sections to be the orifices of large tubes, into which smaller canals open, the lumen of the large tube being eventually lost in the smaller ones. The pores open into spaces beneath the dermal membrane. The current enters through the pores, passes through a number of delicate canals into larger, and finally into the largest, emerging as exhalent currents of the oscular. These currents are maintained by the lashing movements of flagella which line the walls of the enlargements mentioned.

* Under this heading will be included all Abstracts relating to the Embryology, Histology, etc., of Vertebrates and Invertebrates.

† Science Gossip, January, 1889.

BOTANY.*

POLLEN MOTHER-CELLS.†—Byron D. Halsted says that pollen mother-cells in excellent condition for study may be found in the young anthers of *Negundo aceroides*, Moench. Sections may be obtained by cutting across the staminate flowers before they have attained half their full size. When the sections are not too thin, the thecæ will be found made up of a single whorl or circle of mother-cells, many of which are pear-shaped, due to unequal pressure. The mother-cells in the center of the thecæ easily become detached, and may be found scattered through the liquid in which the sections are immersed. These loose cells have a strong resemblance to the loose asci of the Erysipheæ (powdery mildews), and the fair pollen grains may be found in all stages of development. In the beginning there is only the slightest differentiation of the protoplasm into four indistinct masses. As they become more manifest, the arrangement of the four is found inconstant. Sometimes they are placed with their large diameter parallel, like the four mitlets of a borrage fruit. In others, two are in the same plane, and the other two above or below and at right angles to the first pair. Azorubin is excellent in weak solution for bringing out the young grains more prominently. The pollen grains do not use up the thick mother-wall, and leave pits or cavities as they escape, as young seed in a wax-bean pod.

MICROSCOPY.‡

A NEW MEDIUM FOR MOUNTING STARCHES AND POLLENS.§—Mr. A. P. Brown advocates the use of the following medium for starches, pollens and vegetable tissues :

Selected gum arabic, ℥ ii.

Glycerin.

Distilled water, each, ℥ i½.

Thymol, gr. i.

Put into a wide-mouth, well corked bottle, and place in a warm situation. The mixture should be occasionally stirred until a perfect solution is effected, which usually takes several days. When

* Under this heading will be included all Abstracts relating to the various departments of Botany.

† Botanical Gazette, April, 1889.

‡ Under this heading will be included descriptions of New Instruments, Microscopical Manipulations, Stains and Re-agents, Photomicrography, etc.

§ American Journal of Pharmacy, April, 1889.

all is dissolved, strain through linen and set aside for about a week to get rid of air bubbles, and allow any particles which may have filtered through to settle; or filter through absorbent cotton by using a funnel for hot filtration, which consists of a double tin case holding water, kept at the required temperature by a spirit lamp placed under the projecting area. A glass funnel fits inside the hot-water bath, a plug of absorbent cotton is placed in the funnel, and the solution is passed through it. After filtration, it is best preserved in compressible tubes.

To mount starches or pollens, a clean slide is breathed on and then dusted over with the starch or pollen to be mounted. The surplus is removed by gently tapping the slide against any hard substance—a table, for instance. Enough of the starch will adhere to the slide, and will be nicely distributed over the field. A drop of the mounting medium is now carefully placed on the slide, and the cover placed over it. If there are any air-bubbles in the mounting medium when placed on the slide, they should be carefully picked out with a mounting needle. If the medium is kept in a compresible tube, there is not much danger of air bubbles on squeezing out a drop; or if there are any, they will be on the surface, and can be be readily removed with a mounting needle. The slide can then be finished immediately by running a ring of any kind of cement around the edges of the cover-glass, and the mount is permanent. The medium can be colored blue by adding a small quantity of anilin blue, although it is not necessary, as the structure of the starches can be plainly seen. They should be examined by centra and oblique illumination, and with the polariscope, to give the student interested in this subject an idea of the beauty of starches and pollens.

MOUNTING FISH SCALES.*—Mr. Frederick DuBois gives the following directions for preparing and mounting the scales of fish: Place the scales in a small, wide-neck bottle of caustic potash for forty-eight hours, then boil for a few minutes in plain water, and afterwards wash in hot water. Partially dry the scales between blotters, and place in alcohol for quarter of an hour to remove all moisture. The scales are then transferred to clove oil for clearing. Now breathe on a clean cover-glass, and apply side breathed on to a glass slip, to which it will adhere. Place a small drop of benzol-balsam on the cover, put the scale on this, cover it with another drop of balsam, and set aside for twenty-four hours. By the

* The Garner, May, 1889.

following day the balsam will have become thick from evaporation of the benzol. Now place a drop of fresh balsam on the slide, invert cover-glass over it, and the mount is ready for ringing as soon as the balsam is dry. Dry mounts should be made in cells, the scales having previously undergone the same treatment.

PREPARING SECTIONS OF SKIN AND SCALP. (COLE)—Place the skin in equal parts of alcohol and water for thirty-six hours: then in alcohol until required. After sectioning, stain first in following, for 5–10 minutes:

Pure carmine, 60 grains.
Strong ammonia, 120 minims.

Dissolve carmine in ammonia in a test tube, by aid of gentle heat if necessary; filter and add filtrate to four ounces saturated solution borax. After staining, wash sections in alcohol and then transfer to acidulated alcohol (5 parts to 1 HCl). Wash out acid for one hour in alcohol, and then stain in sulph-indigotate of soda for four or more hours. To make this, use a saturated aqueous solution of the sulph-indigotate of soda, and add two drops to the ounce of alcohol when required for use. Clear sections in clove oil and mount in balsam.

CRYSTALS AS MICRO-OBJECTS.*—Crystals of the various metals furnish interesting and often beautiful objects for the microscope, and as they are, for the most part, easy to prepare, quite a variety may be kept on hand for "show" purposes, if not for their scientific value. Prof. John Bolton, of Cleveland, furnishes two such slides to Box L, Am. Postal Micro. Club. He says: *Silver* may be precipitated from the nitrate by arsenic, antimony, bismuth, zinc, tin, etc. *Copper* from the chloride by bismuth, zinc, tin, lead and iron. *Gold* from the chloride with the reagents mentioned under silver. (By consulting a good work on chemistry, many methods of obtaining crystals may be found.—EDITORS.)

IMPROVED POLARISCOPE.†—At a recent meeting of the London Physical Society, Dr. S. P. Thompson advocated a polariscope formed from a rectangular block of spar, two faces of which are perpendicular to the optic axis, two cuts parallel to the axis are made from the middle of one side to the ends of the opposite, and the surfaces polished and cemented with Canada balsam. A short prism with wide angle is thus obtained, which can be readily fitted to the

*Am. Postal Microscopical Club's Note book, 1888.
†Scientific American, Feb. 1, 1888, p. 69.

substage of the microscope. The analyzer consists of two wedges of spar, mounted in a tube which fits on the eyepiece. As the upper end of this need not be larger than the pupil of the eye, the length of the prism may be considerably reduced, and still keep the bottom end large enough to collect all the rays passing through the eyepiece.

MISCELLANEOUS.

SPECTACULAR CHEMISTRY.*—At the banquet recently held by the congress of German chemists, some novel scientific diversions were exhibited. Among them, one in particular attracted special attention. Hoffmann, of Cologne, gave a short lecture enumerating the difficulties experienced by students in remembering the constitution of organic compounds, and proposed an original method of fixing the formulæ in their memory.

A ballet then commenced, in which the corypheès, dressed in various colors, represented the different atoms. Under the direction of the professor, the atoms grouped themselves in different attitudes, representing the chemical compounds and their reactions. Specially noteworthy were the composition of benzol, and anilin and its derivatives. On the formation of fuschine, or any of the coloring matters, brilliant lights illuminated the groups. The representation terminated in the explosion of one of the substances. This "excelsior ballet" was the crowning event of the evening.

RECREATIONS OF THE MICROSCOPE.—If, reader, you have ever looked through a solar microscope at the monsters in a drop of water, perhaps you have wondered to yourself how things so terrible have been hitherto unknown to you. You have felt a loathing at the limpid element you hitherto deemed so pure. You have half fancied that you would cease to be a water-drinker ; yet, the next day, you have forgotten the grim life that started before you, with its countless shapes, in that teeming globule; and, if so tempted by your thirst, you have not shrunk from the lying crystal, although myriads of the horrible Unseen are mangling, devouring, gorging each other, in the liquid you so tranquilly imbibe. So is it with that ancestral and master element called Life. Lapped in your sleek comforts, and lolling on the sofa of your patent conscience, when, perhaps for the first time, you look through the glass of science upon one ghastly globule in the waters that heave around,

* L' Union Medicale.

that fill up with their succulence the pores of earth, that moisten every atom subject to your eyes or handled by your touch, you are startled and dismayed. You say mentally, "Can such things be? I never dreamed of this before! I thought what was invisible to me was non-existent in itself. I will remember this dread experiment." The next day the experiment is forgotten.—*Bulwer.*

IMPORTANCE OF BACTERIOLOGICAL INVESTIGATION TO CITY HEALTH.* —M. Charles Girard, *chef* of the Paris Municipal Laboratory, has forwarded a report to the Municipal Council, strongly recommending the establishment of a micrographic laboratory, the direction of which should be confided to doctors of medicine who have proved themselves qualified to undertake such an office; that is, they must be chemists or bacteriologists specially educated for the purpose. The following are some of the most important passages on which the recommendation is founded. The necessity for the research of pathogenic bacteria is becoming more and more urgent, particularly as regards milk and water, which are now recognized as being in the first rank of the means of the propagation of infectious maladies. To say nothing of the germs of small-pox and scarlet fever, which are conveyed by milk, the transmission of tuberculosis by this liquid, which has been so energetically discussed for some years, now counts but few adversaries in the medical world, and already several Commissions of Hygiene of the Department of the Seine have expressed a wish that the search for the bacilli of phthisis in milk should be effected at the laboratory concurrently with the chemical analysis. Besides the study of milk, the same functionary may make at the Municipal Laboratory researches on the water employed for domestic purposes for the bacilli of typhoid fever and the bacillus of cholera, researches which are frequently demanded by the municipalities of the provinces. The same persons may be charged to examine ciders, beers, wines and preserves, in respect to alterations and maladies, of which they are the object. The study of aliments in the same direction presents great difficulties, and exacts on the part of one who has charge of this department an assiduous attention and incontestable technical capacities.

NEWS AND NOTES.

HE who takes up the study of bacteria enters a veritable wonderland, and the deeper into it he dips the greater will be his surprise, amazement and delight. He will be amazed to learn how

* The *Lancet*, October 6th, 1888.

important a role they play in life, and that his very continuance in life depends upon their presence in, or absence from, his system; and he will be delighted with the new world of knowledge presented to him. A new science has been created, that of mycology, which to-day is exciting more general interest, and engaging more thought and study, than most of the older sciences. A new literature of surprising extent and variety is being created, and so eager and numerous are those who occupy their time with it, and so steady is the stream of their discoveries, that we seem to be but on the threshold of what we are to know in the near future.—*Allan, in Independent Practitioner.*

THE firm of W. H. Walmsley & Co., of Philadelphia, has been dissolved. Mr. Walmsley's former partners, Messrs. Earle & Collins, will continue the business, and will remain the sole American agents for the well-known R. & J. Beck microscopes. The place of business will remain the same.

THE *Revue Mycologique* is of interest to mycologists, not only on account of the original communications which appear in its pages, but particularly for the excellent summary in each number of the literature of the subject.

THE special internal anatomy of the *Uropoda krameri* is described by Albert D. Michael, F. Z. S., in the February issue of the *Royal Microscopical Journal.* In the same journal a list of the desmids from Massachusetts is published by Mr. William West, from specimens furnished by Mr. J. M. Lyle, of Amherst College. Both of the above papers are illustrated.

GEORGE S. ALLAN, D. D. S., of New York, contributes an article on The Etiology of Dental Caries to the March *International Dental Journal.* Of the Heitzmann-Abbott theory, he says "it is fallacious from the foundation up."

THE last-written examination questions propounded to the senior class of the St. Louis College of Pharmacy, for the prize in microscopy, are a model of their kind; and the practical work demanded of the student in this connection, indicates the thoroughness with which botanical microscopy is taught at this institution.

IN HIS remarks on the transmission of disease from animals to man, Prof. Walley states that, in his opinion, tuberculosis might be transmitted by fowls' eggs. A report of this interesting discussion is printed in the *Journal of Comparative Medicine and Surgery,* October, 1888.

MR. THOMAS A. WILLIAMS contributes to the January number of the *American Naturalist* an interesting paper on "The Status of the Anglo-Lichen Hypothesis."

MR. ANTHONY WOODWARD publishes in the *Journal of the New York Microscopical Society*, January, 1889, a preliminary list of foraminifera from the post-pliocene sand at Santa Barbara, Cal. The list comprises twenty-eight species.

BOOK REVIEWS.

EXTRA-UTERINE PREGNANCY: A Discussion. From the Transactions of the American Association of Obstetricians and Gynecologists, 1888. Together with an editorial review of Tait's Ectopic Pregnancy and Pelvic Hematocele, from the Buffalo *Medical and Surgical Journal*. Philadelphia: Wm. J. Dorman, 1889. Cloth; illustrated. Price, 75 cents.

This is a valuable contribution to an important subject by a number of well known practitioners of medicine. It will be found of interest to both generalist and specialist. We cordially recommend it to our medical readers.

THE ETIOLOGY, DIAGNOSIS AND THERAPY OF TUBERCULOSIS. By Prof. Dr. H. von Ziemssen. Physicians' Leisure Hour Library. Detroit: Geo. S. Davis. Paper; pp. 118.

This latest publication of an eminent clinical teacher contains a synopsis of our knowledge of the subject named in the title of the book. While there may not be anything new said on tuberculosis, the name of Prof. Ziemssen is sufficient guarantee that what is said is well said. The book is a worthy addition to this practical and handy series.

SIXTEENTH ANNUAL REPORT of the Secretary of the State Board of Health of the State of Michigan, for the year ending June 30, 1888. Lansing, 1889. Cloth; pp. 328.

This excellent volume is one of the best yet issued by the State Board of Health of this State, and contains a large amount of information, the result of careful and painstaking research and personal experience. While reports of this nature are apt to be dry reading, Dr. Baker, the Secretary of the Board, deserves great credit for the able manner in which he has arranged his material. A copious index at the end of the book adds greatly to its value as a work of reference.

FOOD PRODUCTS.

Under this title, Dr. Thomas Taylor, the government microscopist, has brought out a valuable pamphlet on twelve edible

mushrooms found in the United States, with directions for se ecting, and preparing them for the table. The paper before us is a reprint from the annual report of the United States Department of Agriculture for 1885. A lithographic plate illuminates the text. We are sure that Dr. Taylor will receive the thanks of every lover of agarics for his admirable contribution to the subject. We regret to notice that the distinguished author has neglected to add the *American Society of Microscopists* to the list of societies of which he is a member.

THE TRAINED NURSE. Buffalo, N. Y.: The Lakeside Publishing Co., publishers.

This excellent magazine is devoted to those who minister to the sick and suffering. It is ably edited by Miss Margaret Elliot Frances, herself a trained nurse, and thus in a position to know just the needs of this class of readers. Besides the matters of especial interest to nurses, there is much in the magazine which will be found instructive to physicians, and especially to mothers and all who have to do with children. The price of *The Trained Nurse* is $1.50 a year. We can furnish it in club with THE MICROSCOPE for $2.00.

THE Bausch & Lomb Optical Co. have issued a supplementary catalogue of microscopes, objectives, etc., the supply of the eleventh edition of their large catalogue having become exhausted.

CATALOGUE DE LA BELLE COLLECTION de Coléoptères Européens et Exotiques, etc. Paris: Emile Deyrolle, naturaliste, 46 Rue du Bac.

COMMERCIAL UNION WITH CANADA. Speech of Hon. Robert R. Hitt, of Illinois, in the House of Representatives, Friday, March 1, 1889.

COLLEGE MEMORIES. Poem read before the Adrian College Theological Society, March 23, 1889, by W. F. Cogswell.

EPICYSTIC SURGICAL FISTULA for Cystocopic Exploration, Intravesicular Treatment and Drainage. By John D. S. Davis, M. D. Reprint.

THE PRINTERS AND MR. CHILDS. Reprint.

CHRONIC BRIGHT'S DISEASE in its Relations to Insanity. By E. P. Christian, M. D. Reprint.

THE CHEMICAL PHILOSOPHY IN REMEDY. By Hugh Hamilton, M. Sc., M. D.
THE CHEMICAL FACTOR IN DISEASE. By Hugh Hamilton, M. Sc., M. D. Reprints.

ADDRESS OF ALBERT R. BAKER, M. D., at the opening of the Medical Department of Wooster University, Cleveland, Ohio, Wednesday, February 27, 1889. Reprint.

ON THE SERIAL RELATIONSHIP of the Ambulacral and Adambulachral Calcareous Plates of the Star Fishes. By J. Walter Fewkes. Reprint.

ANOPLOPHYRA ÆOLOSOMATIS, a New Ciliate Infusorian Parasitic in the Alimentary Canal of *Æolosoma chlorostictum*, W. M., MSS. By Henry H. Anderson, B. A. Communicated to the Microscopical Society of Calcutta. Reprint.

REPORT OF THE CENTRAL PARK (NEW YORK) MENAGERIE, 1888.

NEW FORM OF POSTERIOR COLPORRAPHY. By J. H. Kellogg, M. D. Reprint.

EXPERIMENTAL RESEARCHES Respecting the Relation of Dress to Pelvic Diseases of Women. By J. H. Kellogg, M. D. Reprint.

ON THE ETIOLOGY OF DIPHTHERIA, an Experimental Study. By T. Mitchell Pruden, M, D., etc. Reprint.

CORRESPONDENCE AND QUERIES.

TUSCALOOSA, ALA.

EDITORS MICROSCOPE:

Apropos of section-fixing, I would suggest the following slight variation of the method generally adopted in the use of the clove oil-collodion process, which I have found to combine the convenience and readiness of appplication of a liquid fixative with the undoubted advantages offered by the dry-film methods, in that it allows the preliminary arrangement of the section, or a number of sections, on the slide, and the easy removal of folds and wrinkles, which latter, especially with large, thin sections, is often impossible if tissue must lie as it falls :

Place the section (paraffin imbedded) on a perfectly clean slide. Arrange and smooth out folds with a camel's hair brush dipped in alcohol. Hold an instant over alcoholic flame until paraffin partially melts and section adheres. Paint over section, and slide a thin film of the collodion mixture. Press down with the thumb a bit of tissue paper coated with same mixture, in the manner recommended by Dr. Reeves, to insure close contact. Planish with mounting forceps, remove paper, and place the slide on brass table, or water bath at the melting point of paraffin, until clove oil is evaporated, when section will be found firmly attached, and slide can be passed through benzol, alcohol, stains, etc., without danger of separation.

Mayer's albumen process can also be used as above, and is satisfactory. Frenzel's gutta-percha and Threlfall's caoutchouc methods are also reliable, but I think the collodion process, used in the manner described, is most available and most certain in its results, and I, for one, feel no need of a better plan.

Very truly, E. D. BONDURANT, M. D.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS *who have microscopical apparatus, material or books which they wish to exchange, and such wants will be* INSERTED FREE OF CHARGE. *The number of insertions given will depend upon the number of exchanges received each month. Subscribers will please notify us when articles have been exchanged or sold. Dealers are referred to our advertising department.*

WANTED—Vols. I to VI of THE MICROSCOPE. Apply, stating price, to this journal.

FOR EXCHANGE—A large variety of minerals and rocks, some polished; also fossils, and reptiles in fluid, for mounts. Address,
PROF. J. E. TALMAGE, Salt Lake City, Utah.

FOR SALE—First-class duplicate objects, five for $1. You can get your objects in any class you may name, except pathological; but no time for lists. If you do not get $1 worth, money will be returned on day after slides are returned.
E. C. HOYT, 154 Howard St., Detroit, Mich.

FOR SALE—Vols. IV, V, VI, VII, of THE MICROSCOPE, bound in two volumes; fourth edition of Wyeth's "The Microscopist;" Marsh's "Section Cutting," and Phin's "How to Use the Microscope." For cash only.
H. M. RICHARDS, 27 Ellery St., Cambridge, Mass.

FOR SALE—A Bausch and Lomb Model Microscope (No. 521 of their catalogue), as good as new, having been used but a few times. There are two objectives, a 1 inch and a ¼ inch, one 2 inch eye-piece, camera lucida, etc. Everything in perfect order. Will be sold cheap. Correspondence solicited. Address,
S. G. ROBBINS, Siverly, Pa.

WANTED—THE MICROSCOPE, Vol. I to VI inclusive.
W. E. SWIGERT, Spencer, Owen Co., Ind.

WANTED—Several good objectives and eye-pieces; must be in first-class condition. State full particulars. Also want unmounted material. Will exchange or buy. Correspondence invited. CHAS. VON EIFF, 20 Palmetto St., Brooklyn, N. Y.

WANTED.—Vol. VI, No. 1.
LANCET & CLINIC, 199 W. 7th St., Cincinnati, Ohio.

WANTED—Histological and pathological material to cut on the halves. Nothing but first-class material desired. Address C. B. CLAPP, M. D., Danville, Ill.

FOR SALE—Choice slides of encysted trichina spiralis in muscles of cat, with cystic plexus of capillaries injected red; very fine. Write at once for these novelties.
FRANK S. ABY, Iowa City, Iowa.

RARE MOUNTS for sale or exchange: hair of *Ornithorhynchus paradoxus*; mummy cloth, three thousand years old; sections of bark from Charter Oak tree. Address
PROF. H. M. WHELPLEY, St. Louis, Mo.

FOR EXCHANGE OR SALE—For microscopical materials or offers: A good Toepler-Holtz Electrical Machine, 12½ inch revolving plate, and current breaker, Leyden jar, Geissler tubes and numerous other accessories, the whole costing about $60. Will exchange for a good microscope, and pay difference. Correspondence solicited.
F. F. WOOD, Prin. Blair Graded School, Blair, Wis.

WILL EXCHANGE—A complete set, up to 1889, of the Journal of the (English) Postal Microscopical Society, for good mounts, micro-apparatus, etc. Address
A. B. AUBERT, Maine State College, Orono, Maine.

EXCHANGE—Indian curios, Indian blankets, bows, arrows, pottery etc, gold and silver cabinet specimens, polished, petrified wood, turquois, garnets, amethysts, cactus plants, skins of wild animals, etc., all from Arizona; also, one good second-hand Burt's Solar Compass complete. Will exchange any or all of the above for new or good second-hand Abbe Condenser, polarizer, camera lucida, objectives, eye-pieces, stand, or other good microscopic apparatus. Address W. N. SHERMAN, M. D., Kingman, Arizona.

FOR SALE—A B. & L. Section Cutter, glass top, and micrometer screw, in perfect order, good as new, cost $7.50; will sell for $5.
H. F. WEGENER, 1305 S. Tenth St., Denver, Col.

FOR A CHOICE ASSORTMENT OF MICROSCOPIC SLIDES, send, in exchange, a parcel of minerals and rocks, or of bones and teeth of extinct animals, or of diatomaceous and polycistinous earths, or of diatoms *in situ* on marine algæ. Exchangers will be liberally dealt with. A. J. DOHERTY, 63 Burlington St., Manchester, Eng.

Fig. 1

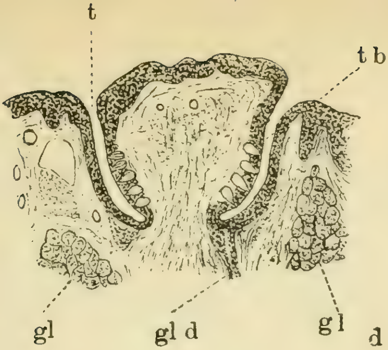


Fig. 2

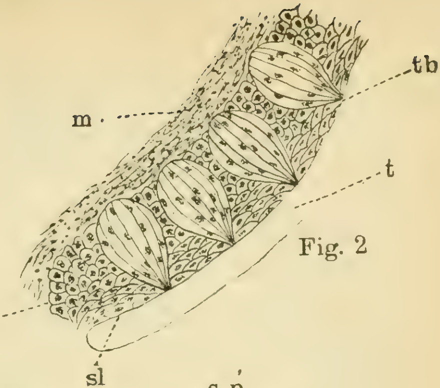


Fig. 3

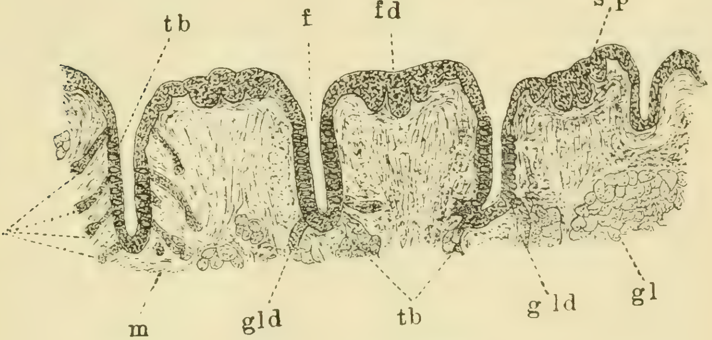


Fig. 4

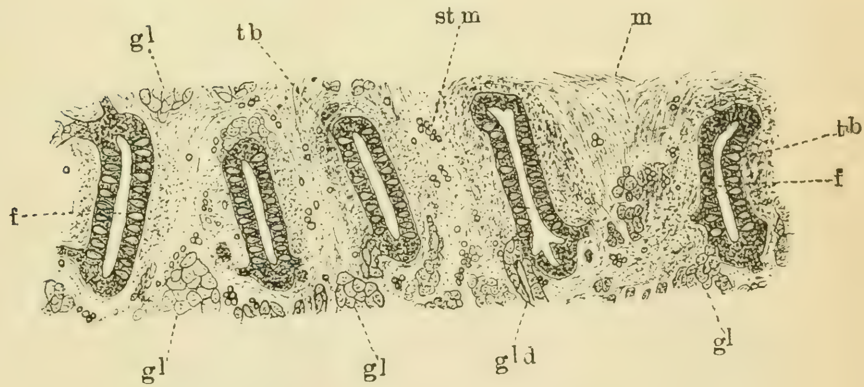


Fig. 5

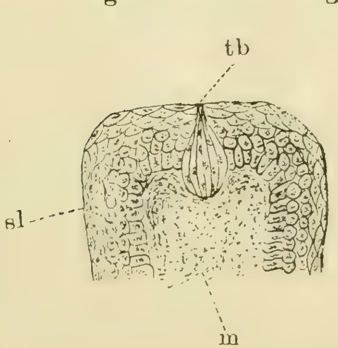


Fig 6.

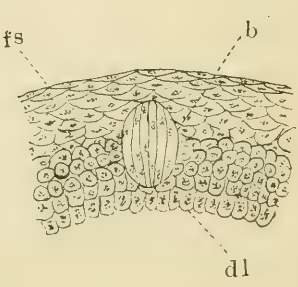


PLATE VII.

THE MICROSCOPE.

PUBLISHED ON THE 10TH OF EACH MONTH,

At 25 Washington Avenue, Detroit, Mich.

All articles for publication, books for review and exchanges should be addressed to the Editors of "THE MICROSCOPE," 25 Washington Ave., Detroit, Mich.

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Specimens for examination should be sent to the *Microscope Laboratory*, 25 Washington Avenue, Detroit, Michigan. In all cases the transportation charges on these specimens must be prepaid.

VOL. IX. DETROIT, JULY, 1889. No. 7.

ORIGINAL COMMUNICATIONS.

ON THE GUSTATORY ORGANS OF SCIURUS CAROLINENSIS.

[PLATE VII.]

FREDERICK TUCKERMAN.

IN the tongue of most Rodentia the posterior portion rises somewhat abruptly above the level of the anterior. The tongue of *S. carolinensis* possesses this characteristic, although not especially well marked. The organ is 40mm. in length, 10mm. in breadth, and 8mm. in thickness, and is perfectly free for 17mm. from the frænum. The papillate surface is usually marked by a superficial longitudinal groove extending along the anterior half to the tip. In some specimens the groove passes directly through the apex, and from thence is continued to the frænum. The dorsum, anterior to the area of the circumvallate papillæ, is thickly beset with small, recurved papillæ of mechanical function. These papillæ vary in form, some being cone and others more or less cylinder-shaped. The latter measure 0.40mm. in height and 0.14mm. in breadth at their widest part, and, in the mid-dorsal region of the tongue, are about 0.35mm. apart. They are more or less flattened on top, with perpendicular sides, and each is seated upon one or more papillary upgrowths of the mucosa. The epithelium covering the papillæ is somewhat imbricated, and the spaces between them are filled to some height with epithelium likewise imbricated in arrangement. Not infrequently the papillæ have one or more cornified spines projecting from their upper surface, the points of which are directed inwards

and backwards. The cone-shaped papillæ investing the upper surface and sides of the anterior half of the tongue do not differ in character very materially from ordinary conical papillæ. About the gustatory area and root are thick, fleshy, cone-shaped elevations, the apices of which are turned backwards. Fungiform papillæ of the normal type are distributed over the upper surface and sides of the organ, attaining their maximum size in the tract directly in front of the circumvallate papillæ.

The circumvallate papillæ are three in number and are situated well back on the dorsum. They are arranged in an isosceles triangle, the apex of the triangle being backwards. At each side of the tongue, near the base, is a papilla foliata. The inner border of these papillæ is marked by a fringe of large, fleshy papillæ, the apices of which are directed upwards, inwards and backwards. This fringe is continued for some distance on to the glosso-palatine arch.

GUSTATORY STRUCTURES.

The Circumvallate Papillæ.—These papillæ show no indications of lobation. Their upper surface, which is somewhat uneven, overtops the surrounding lingual area. The epithelium covering their free surface measures about 0.07mm. in thickness, being a trifle thicker than that protecting the sides. The lateral walls of the papillæ curve downwards and inwards, giving them a rather constricted base. The trench encircling each papilla is deep, narrow, and quite uniform in breadth. Serous glands are fairly abundant in the underlying stroma, and also occur within the papillary body itself. Their ducts open into the trench at its deeper part. Nerves of considerable size enter the papillæ at their base, and their branches (which are for the most part non-medullated) radiate to the summit and lateral regions of the papillæ, in the mucosa of which they cease to be longer distinguishable.

The taste-bulbs of the circumvallate papillæ are only fairly numerous. They are disposed at the sides in a zone of four to six tiers, the uppermost tier being about opposite the middle of the trench. I failed to detect taste-bulbs in the epithelium of the free upper surface of the papillæ, and they were likewise wanting in that investing the outer wall of the trench. From horizontal sections, made at different levels, I estimated the number of bulbs in a tier at fifty. If we allow for five tiers, we shall have two hundred and fifty bulbs for each of the three papillæ. The bulbs present the usual amount of variation in size and shape. (Fig. 2 shows their external structure magnified 240 diameters.) The mean length of the bulbs is 0.057mm., and their mean breadth 0.032mm.

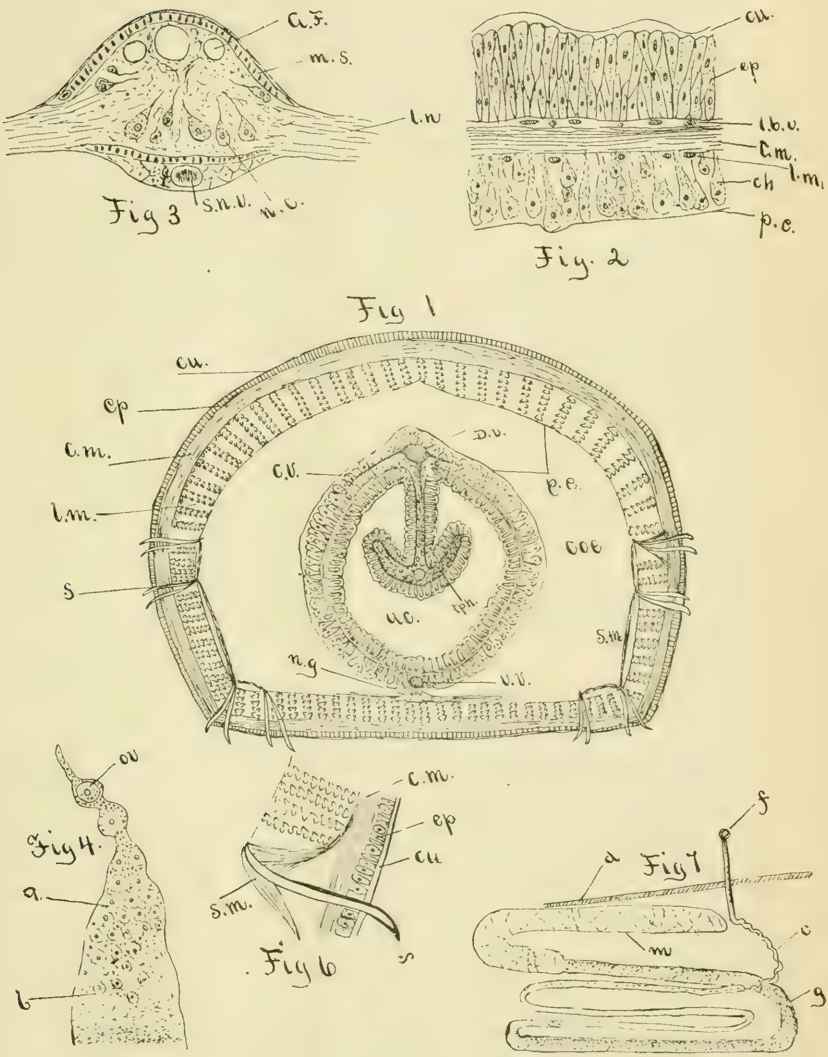
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Fig 4.
a.
b
c.m.
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cu
s.m.
s
Fig 6
f
a
Fig 7
m
c
g

PLATE VIII.

The Papillæ Foliatæ.—The exposed surfaces of these papillæ are somewhat flattened. Each papilla consists of five bulb-bearing folds, possessing the same general appearance, but varying somewhat in size. The furrows separating the folds are quite narrow, with a nearly uniform breadth throughout, and have an average depth of about 0.5 mm The folds are for the most part simple in construction. Each one bears secondary papillæ at its upper part, the depressions between which are filled by the epithelium. Serous glands and ducts are abundant, aud the latter discharge into the furrows at different levels. (The foliate papilla is shown in figs. 3 and 4.) The taste bulbs of this area are, as a rule, restricted to the lower two-thirds of the folds, although occasionally they completely fill the sides of a fold. They are usually arranged in eight tiers, though there may be more. Judging from horizontal sections, the number of bulbs in each lateral gustatory organ is about eleven hundred.

The Fungiform Papillæ.—These papillæ commonly bear a single taste-bulb at their upper part. The bulb usually lies vertically, directly in the long axis of the papilla, with its apex penetrating (but not invariably perforating) the outer homogeneous layers of stratified pavement epithelium, and its base resting in a depression of the mucosa. The bulbs of this region are somewhat pyriform in shape, and measure 0.051 mm. in length, their greatest transverse diameter being 0.025 mm.

At the lower part of the posterior surface of the epiglottis I found a few isolated bulbs embedded in the stratified epithelium. The apices of these bulbs fail to pierce the superficial strata of the epithelium, and their bases but rarely touch the mucosa. They measure from 0.039 to 0.048 mm. in length and are 0.030 mm. in breadth. Small mucous glands are very abundant in this region, and their ducts, which are numerous, quite straight and more or less parallel, perforate the epithelium and open on the posterior surface. No ducts were observed communicating with the anterior surface of the epiglottis.

EXPLANATION OF PLATE—REFERENCE LETTERS.

b., bulb; *d. l.*, deep lamina of epithelium; *f*, furrow; *fd.*, fold of the papilla; *f. s.*, free surface of the epithelium; *gl.*, serous gland; *gl. d.*, duct of serous gland; *m.*, mucosa; *st. m.*, striated muscle-fibres; *s. l.*, superficial lamina of epithelium; *s. p.*, secondary papillæ; *t.*, trench; *t. b.*, taste-bulb.

Fig. 1 x 40. Vertical section through one of the circumvallate papillæ.

Fig. 2 x 240. Vertical section through one side of the base of the same circumvallate papilla, showing the bottom of the trench and the four lowest tiers of taste-bulbs. *t. b.*, Taste-bulb, the reference mark indicating the apical end.

Fig. 3 x 40. Transverse vertical section through one of the papillæ foliatæ.

Fig. 4 x 40. Horizontal section through the upper part of one of the papillæ foliatæ. *st. m.*, Striated muscle-fibres which have been divided transversely to their long axis.

Fig. 5 x 240. Vertical section through a fungiform papilla of the mid-dorsal region of the tongue, showing a single taste-bulb at its upper part. The two upper thirds of the bulb are embedded in the epithelium and the lower third rests in a depression of the mucosa.

Fig. 6 x 240. Transverse vertical section through the lower part of the posterior surface of the epiglottis. *b.*, Bulb-like structure, entirely epithelial in position.

Amherst, Mass.

HISTOLOGY OF THE EARTHWORM.

L. W. CHANEY, JR.

[PLATE VIII.]

THE earthworms are of special interest to the biologist for several reasons. Their simple and representative structure fits them for elementary study, and their economic importance, as shown by Darwin, gives them practical interest. As presenting many interesting histological details, they are attractive to the worker with the microscope. The preparation of them for microscopic study is a somewhat tedious process, but the result of patient manipulation is ample reward to the interested student. As in many of the lower animals, so here, the precautions necessary to a good preparation must begin in the killing of the animal. Several methods of killing and hardening have been tried, none, on the whole, giving better results than that recommended in Sedgwick and Wilson's Biology. It is briefly as follows: The worms are placed in a shallow dish and covered to the depth of half an inch with water. Strong alcohol is then dropped, a few drops at a time, upon the surface of the water. This is repeated at intervals of five minutes, until the worms cease movement and lie easily extended. The process takes from three to five hours. Care is necessary that the process be not hurried at all, as undue haste causes a shrinkage of the tissues, which will be most aggravating when the section is viewed. The worms, thus carefully deprived of life, should be plump and straight. They should then be placed closely side by side in a dish, and covered with 50 per cent.

alcohol. After one or two hours they may be transferred to stronger alcohol. The best results have been attained by slowest increase, as passing at intervals of three hours through 60%, 70%, 80%, 90%, to 95%, finally, in which they may be kept until wanted. If time and patience fail, the 60% and 90% may be omitted.

When ready to prepare for sections, the worms may be cut into pieces, preferably such as will include certain regions of the body. For instance, the first seven segments will include the pharynx, the second seven will have the reproductive organs, the third seven will have the crop and gizzard, and a portion of the stomach-intestine; any portion further back will show the peculiarities of the stomach-intestine.

The pieces thus cut may be stained as a whole, or the imbedding may be first performed, and the sections stained upon the slide. For rapid work, staining in toto is to be preferred; by the other method a slightly sharper definition of some of the tissue elements may be secured. Double staining has not been tried. In the imbedding, the method first suggested, I believe, by Hoffmann, of placing the paraffin cup with the object in a vacuum has been tried, with good results. The usual method is to transfer the stained pieces to turpentine, leaving them until they have acquired a semi-transparent appearance; then to turpentine having so much paraffin dissolved in it that it will remain liquid at a temperature of 30° C; thence to soft paraffin, finally to hard paraffin.

The sections were cut either with the Bausch & Lomb microtome or with the Ryder automatic. A thickness of $\frac{1}{1000}$ to $\frac{1}{1500}$ of an inch gave very satisfactory results. In some regions, serial sections are almost indispensible, as, for instance, in the locality of the crop and gizzard.

The section chosen for special description was cut from the neighborhood of the fortieth segment, and was taken because of its relative simplicity, and because it shows several features of much interest. The general form of the body in section is shown (Fig. 1) to be circular and somewhat flattened beneath. At four points upon the circumference the groups of setæ protrude (*s*, Fig. 1). These groups are arranged in four longitudinal rows. The setæ themselves have the shape shown in Fig. 6. The musculature is so arranged that the setæ may be turned in any direction, forward or backward, up or down. They thus form reversible holdfasts by which the animal manages its progress either through the earth or in its tunnels. The groups are connected by internal muscles which cause them to work together (*s m*, Fig. 1). The microscope reveals

in the body wall the following clearly marked layers as shown in Fig. 1. *Cu*, is a thin, structureless cuticle. It is thin and, under certain conditions, it separates readily from the subjacent tissues. It is marked with fine parallel striæ, which give the irridiscence peculiar to thin films. It is perforated by many pores, through which are discharged the products of gland cells lying in the next layer, *ep*. This consists of columnar cells, many of which are enlarged to an oval form by the accumulation of mucus or other products. The layer *c m*, is muscular, the fibres running in a circular direction. The investigation of these fibres is not, as yet, satisfactory, and no account of them has come to notice. They are much elongated, and a very small oval nucleus can sometimes be detected. At *l m*, appear the longitudinal bands of muscles. Their peculiar appearance is due to the arrangement of the bundles of fibres. On each side of a flat plate are arranged the lateral ridges which in section appear as delineated. In longitudinal section the circular muscles show the same structure, but in a less marked degree. Within the muscular layers is the thin layer *p e*, of peritoneal epithelium. This is reflected, and also covers the alimentary canal. It is extremely difficult to make out, and is doubtfully visible in cross sections. By means of other preparations it becomes evident that the tissue consists of flattened pavement cells united at their edges, and having a vascular net-work just beneath. It will be readily seen from the figure that the wall is marked off into eight regions, with limits shown by the setæ. Upon the back, the color is darker than at the side or beneath. This is found to be due to masses of pigment disposed among the fibres of the circular muscular layer.

The cavity marked *cœ*, in this figure, is known as the cœlomic cavity. It is divided by cross partitions extending from the body wall to the intestine into a series of ring-like spaces which correspond to the external segmentation of the body. In this cavity there circulates during life a fluid which has histological features worthy of notice. This cœlomic fluid is nearly colorless, or with a slight milky tinge, and in it float amœboid cells. The fluid is likely also to harbor a considerable number of parasitic protozoa, especially the elongated gregarines. These may be obtained by drawing the worm through the fingers, forcing the fluid into one end. If then the swollen extremity be punctured with the point of the scalpel and the issuing drop received upon a slide, it affords means for a very interesting study.

In the center of the figure is the alimentary canal. At *d v*, is the dorsal blood vessel which runs the whole length of the worm

as a pulsating canal, serving the double purpose of a heart and artery. At *v v*, is the ventral vessel, also extending the entire length, and conveying blood backward. These are connected by *c v*, the circular vessels, which at this point are usually two pairs in each segment, but break up into finer vessels as they pass downward from *d v*. At *n g*, just below the intestine, is the nerve ganglion, described later. The most striking peculiarity of this portion of the canal is the infolding *tph*. This is designated the typhlosole. The object is plainly to increase the absorbing surface. In the specimen from which the drawing was made, the typhlosole has a shape differing from that shown in any figure with which I am familiar. It is also different from sections taken from other worms. Whether the anchor shape is simply an individual peculiarity, or is characteristic of some species, is not yet ascertained. It will be noticed that at the point where the branches leave the central bar of the anchor, there is a blood vessel. From the dorsal vessel there are branches running downward into the typhlosole, which break up into a capillary net-work, and doubtless communicate with the large vessel in the lower part of the typhlosole.

In Fig. 2, a portion of the alimentary wall is shown more highly magnified. At *cu*, is the internal cuticle, entirely similar to the external layer of the body, and continuous with it. The epithelial layer *ep*, differs from the similar layer of the body-wall in having larger cells, many of them of a distinctly club shape, and all having conspicuous nuclei. These cells appear to be active in the secretion of digestive fluids. At the bases of these cells are blood vessels (*l b v*), forming a loose net-work. Next comes a layer of circular muscles (*c m*), and then scattered bundles of longitudinal muscles. Surrounding these is the layer *ch*, consisting of large, pear-shaped cells, which, in fresh specimens, have a greenish tinge. These cells cover the entire canal at this point, being most abundant at the dorsal side. They extend down into the typhlosole, and have about the blood-vessels a radiate arrangement. As their function is not fully understood, they are generally designated as cholagogue cells. It seems probable that they at least perform an office analogous to the glycogenic function of the liver in higher animals. This supposition is strengthened by the arrangement of the cells in relation to the blood vessels.

Fig. 3 represents on an enlarged scale the nerve ganglion shown at *n g*, Fig. 1. One of these ganglia is found in each segment, and from them extend two pairs of lateral nerves. They are connected with each other by a longitudinal commissure. At

g f, Fig. 3, are certain hollow cylinders of problematical importance. They extend along the commissures the entire length of the body. Over the top and beneath is a sheath (*m s*) of muscular fibers extending lengthwise. Beneath the ganglia and the longitudinal commissures runs a blood vessel (*s n v*). The ganglion is somewhat distinctly bilobed; the large nerve cells (*n c*) are arranged somewhat clearly with reference to a median vertical plane. These cells, it will be noticed, strongly resemble the unipolar nerve cells of the human nervous system. It is not possible to trace distinctly the continuity of the processes with the nerve fibers which make up the body of the ganglion. *L n* shows the lateral nerves which extend out to the body wall.

Fig. 4 shows the ovary. A pair of these are found in the thirteenth segment attached to the hinder face of the dissepiment, between it and the twelfth. The ova at *ov*, near the small end of the pear-shaped mass, are nearly mature. Passing toward the base, they are less distinct, until they are finally not to be distinguished from the other cells of the ovary. About each ovum is a layer of very small cells, which serve to nourish the ovum to the point of maturity. The ova are finally discharged into the cœlomic cavity, and reach the outside by special ducts.

Fig. 7 represents one of the excretory organs, called nephridia. Of these, there is a pair in each segment having an internal opening by the funnel (*g*). This funnel extends through the dissepiment (*d*) into the next anterior segment. This funnel and the tube (*c*) into which it leads, are richly ciliated. The portion *g* has thicker walls, and is lined with a glandular layer of epithelial cells. This glandular portion opens into a muscular sac, *m*, which opens by a pore upon the surface of the body. In passing, it is worth noting that many of these features are essentially those present in the excretory system of higher animals.

I have in this brief review touched upon a few of many interesting details which present themselves in the study of these humble excavators. They are enough, I trust, to show that there are few objects available to the histologist from which a greater number of fundamental facts can be demonstrated.

DESCRIPTION OF THE FIGURES.

FIG. 1.—A diagrammatic sketch of a cross-section taken at about the fortieth segment: *c*, structureless cuticle; *c p*, columnar epithelium; *c m*, circular layer of muscles; *l m*, longitudinal muscles; *s*, setæ; *cœ*, cœlomic cavity; *a c*, alimentary cavity; *tph*, typhlosole; *d v*, dorsal blood-vessel; *c v*, circular blood-vessels,

v v, ventral blood-vessel; *n g*, nerve ganglion; *p e*, peritoneal epithelium; *s m*, setal muscles.

FIG. 2.—Highly magnified cross-section of wall of alimentary canal: *cu*, cuticle of inner surface; *c p*, columnar epithelium; *l b v*, blood vessels; *c m*, circular muscles; *l m*, longitudinal muscles; *ch*; chloragogue layer; *p e*, peritoneal epithelium.

FIG. 3.—Transverse section of nerve ganglion: *g f*, giant fibers; *m s*, muscular sheath; *l n*, lateral nerve; *n c*, nerve cells; *s n v*, sub-neural blood vessel.

FIG. 4.—Ovary: *ov*, ripe ovum; *a*, undeveloped ova; *b*, ova not differentiated from other cells.

FIG. 6.—Shows relation of musculature of seta to muscular layers of body wall, *c*.

FIG. 7—Nephridium: *f*, funnel; *c*, ciliated portion; *g*, glandular portion; *m*, muscular portion.

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CONCERNING THE DIFFERENTIATION OF BLACK PIGMENT IN THE LIVER, SPLEEN AND KIDNEYS, FROM COAL-DUST DEPOSITS.*

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IF the process remains confined to the lymphatic gland and its capsule, calcification may result; even the entire gland, together with the capsule, becoming calcified *in toto*. These calcified masses may be conveyed by means of perforations into the air-passages and out of these to the exterior; or, they may cause an obstruction of the air-passages and so directly lead to death by suffocation, or indirectly, by secondary broncho-pneumonia. In regard to this there occur in the literature on the subject a few interesting cases: An observation of Edwards was described in the "Medico-chirurgical Transactions," 1854, vol. 37, p. 151; a second case was published by Roth, "Correspondenzblatt für die Schweizer Aerzte," Jahrgang XIV, 1884; the third was

* Continued from page 170.

dissected and demonstrated by my highly esteemed teacher, Prof. Dr. von Recklinghausen. In this instance it appeared that the entire gland, together with its capsule, was calcified *in toto*, and this mass had penetrated the left principal bronchus, to the walls of which it was still somewhat firmly adherent. Chemical investigations showed that this mass consisted, to a large degree, of carbonate of lime, gelatin-producing substance, and a trace of sulphuric acid. The local changes resulting from the anthracotic indurations of the lymphatic glands are frequent and manifold. They have recently been most elaborately described by Zenker, ("Handbuch der Pathologie," VII, 1, 2, Auflage, 1871, Anhang, page 66), and by Eternot (Recherches sur les affections chroniques des ganglions tracheo-bronchiques et les suites de ces affections, Genf, 1879): and by Oekonomides (Dissertation über die chronische Bronchial-Lymphdrüsen Affection und ihre Folgen, Basel, 1882). From these communications the following is deduced: If the chronic inflammatory process, adenitis and peri-adenitis, continues, it will not remain confined by adhesions with the neighboring organs, such as the bronchia, arteries, veins, lymphatic vessels, or with the œsophagus and the trachea, etc., etc., but may, on the one hand, result in dilatation of these organs by retraction, or on the other hand, in a contraction by compression. Further, Weigert and Roth have asserted that not only the walls of the pulmonary vessels, or bronchus, may become necrosed and break down, but finally become perforated,* whereby the anthracotic pigment may enter the blood directly, as it may on the other hand enter the breathing passages, but that such masses may be conveyed into and carried through the blood by means of the bronchial vessels (arteries and veins) which run along the bronchi and supply them with blood.

Here consequently lies the real etiological moment for the transportation of anthracotic pigment (coal dust) into the various organs, especially the liver, spleen and kidneys, and also into the periportal and mesenteric-lymphatic glands, even into the marrow of the bone, by means of the arterial blood-vessels. This process may well be termed "*Coal-dust or anthracotic metastasis*," as Roth proposed.

The occurrence of this coal-dust metastasis in the liver and spleen is, according to the most recent investigation, by no means infrequent; eleven cases of this kind in one month were investigated

* At the site where this chronic slaty indurated Lymphatic gland lies in contact with a blood vessel or bronchus.

by Roth. I had the opportunity, under guidance of Prof. Dr. von Recklinghausen, of examining carefully twenty-five cases of this kind. These researches were especially directed to the answering of two questions: (1) Whether the pigment deposited in the abdominal organs corresponded microscopically and chemically with that of the enlarged, and for the most part slaty indurated bronchial and tracheal lymphatic glands; and (2) whether the pigment was always present in the abdominal organs, when such a gland had perforated the walls of a vessel or bronchus.

If the organs contain anthracotic pigment it is by no means necessary that they should be changed; they may be normal in size, or they may become enlarged or atrophied, although the two latter changes are not the result of the deposit of pigment, since the pigment produces no irritation whatever in the structure of these organs. The pigment is for the most part taken up by the cells and especially by the leucocytes. Within these organs only it occasionally leaves the cells and settles in them.

THE SPLEEN.

In the spleen it lies principally along the smaller arteries (perivasculæ) and in the marginal zone of the malpighian-bodies (corpuscles), and is also found in the perivascular lymphatic canaliculi, and in the lymphatic vessels of the capsule; it is for the most part confined to cells, especially leucocytes (round cells), and even to the spindle-shaped and star-shaped cells. It presents a fine-grained black pigment which is not affected by caustic soda or potash, caustic ammonia, muriatic, nitro-muriatic, sulphuric acid and ferrocyanide of potash. It is not affected by the various coloring materials which are used in staining the tissues. The coloring fluids which I have used especially are: Carmine, Ranvier's picro-carmine, alum-carmine, Orth's lithion-carmine, borax-carmine, hæmatoxylin, and various anilin colors, such as gentian-violet, methylene-violet, methylene-blue, fuchsin and several others. The black liver- and spleen-pigment correspond exactly, as well microscopically as chemically, with the coal dust of the lungs and of the bronchial and tracheal-lymphatic glands.

IN THE LIVER

It is very rarely visible macroscopically. If it is present it assumes, as is well known, and as Weigert points out, a light-gray color. Microscopically it is seen deposited especially in the periportal interacinous tissue along the small arteries, at times also within the cells of the tissue along the vena centralis, also in the lymphatic vessels of the capsule and in the periportal (interlobular) lymphatic

ducts. It has never yet been possible for me to demonstrate a deposit of coal dust within Kupfer's star-cells of the liver.

IN THE KIDNEYS.

The deposit of anthracotic pigment in the kidneys is of by no means frequent occurrence, although it may exist abundantly in the liver and spleen. I was able, however, in one single case to discover it deposited, although scantily, within an atrophied glomerulus. I think I am able to explain this by the fact that the kidneys are not only very abundantly supplied with blood, but that the blood in them changes very rapidly. In the periportal and mesenteric-lymphatic glands the anthracotic pigment is led by way of the perivascular-lymphatic ducts; which fact may be determined, because the capsule of the lymphatic glands and the peripheric lymphatic ducts are found laden with it.

This black fine-grained pigment is not to be confused with gall pigment (bilirubin); it might more easily be confused with iron-pigment, micrococci, fatty degeneration of the epithelium cells, or with the so-called cells of fat particles (Gluge's corpuscles), or finally with the putrid products of the epithelium.

The iron pigment as it is found in pernicious anæmia, I have discovered either by ammonium sulphate (Schwefel ammonium) or still better with ferrocyanide of potassium, and diluted muriatic acid.

The latter means is preferable, since by its use the microscopical sections have a very intense shade of dark-greenish blue, even microscopically; and it may be seen macroscopically that the iron pigment is colored distinctly green or light blue. In order to produce lasting and beautiful preparations the following is the best method: Allow the sections to lie from 8 to 10 minutes in Ranvier's picro-carmine, then wash them well in distilled water; next place them for 5 or 10 minutes in ferrocyanide of potash, then for a few minutes in diluted muriatic acid; wash again; dehydrate in alcohol absolute, clear in origanum or bergamot oil and embed in xylol, Canada balsam or damarlac. If the cuttings are placed in glycerin the iron pigment, very quickly (within three weeks), loses the blue-green shade and it is then no longer possible to recognize iron pigment as such, until the cuttings have been again successively treated with ferrocyanide of potash and diluted muriatic acid.

The differential diagnosis between coal-dust metastases and micrococci is by no means easy. Both are finely grained and black (brownish black).

(TO BE CONTINUED.)

A SLIDE OF HINTS AND SUGGESTIONS.

J. D. BECK.

I HAVE found slides thoroughly cleaned in two or three hours, in a cold solution of concentrated lye, full strength, in clean, soft water. I have left them in the lye one or two days without any perceptible injury. In my opinion, it cleans them better than the bichromate and acid solution. I put them into a large tumbler half full of lye, one at a time, and in five or six hours pour off the lye and pour clean and soft water on them to cover them, at about 100° F.,* and separate them with a knife, and in ten minutes, or in an hour, pour off and drop them vertically into a clean tin box, punched full of large holes, and turn a stream of clean, soft water on them till thoroughly washed, and drop them into clean water; then proceed as follows: Cut strips of clean newspapers—I prefer white printing paper—three and a half inches wide and any desirable length; take one slide out of the water and lay it on one end of the paper crosswise, and turn it over on the paper and press it down. Then lay another slide on top and roll them over on the paper. Lay the third slide on the upper slide, covered with paper, and roll the pile over on the paper, and so forth until the paper is full of slides, and lay the pile of slides with the loose end of paper under them, or fasten it with mucilage or rubbers.

In this manner there is a sheet of porous paper between every slide in the pile, which absorbs all the water with its impurities, thus leaving the slides dry, clean and free from spots or deposits of impurities in water the usual result when standing them on their ends to drain off, as recommended in micro-technical works. A drop of the *purest-distilled water*, when allowed to dry on a clean slide, will show deposits of impurities difficult to remove. Slides put up in this manner, with so little trouble, are kept cleaner from air and dust than those packed in a box without this protection, and exposed every time the box is opened or uncovered, for days or weeks.

It is not absolutely necessary to keep these papered slides in dust-tight boxes, but it is advisable to keep a half or whole gross of cleaned slides together in one box, with a lid to exclude dust, at least. A paper of six, twelve or more slides can be taken out of a box and one slide removed from the paper, which is easily wiped clean from fibres, or a thin film of moistness, etc., while the rest are well protected at all times.

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* Strong lye, used with heat, is liable to cut or injure glass.

HOW TO DISPOSE OF EXCESS OF MEDIA ON SLIDES.

Get the cover-glass in center of the slide on a turn-table; then spin a ring of the medium around the edge of cover, all that it can take without getting it on top of cover, using a small brush and scraper made of pine or linden, four or five inches long, one-fourth inch wide and one-eighth inch thick, one inch of the ends tapered down to one-sixteenth inch thick, and beveled like a carpenter's chisel, which can be held on a slide while it revolves, so as to force the medium away from the mount or toward it. If the medium is too thick to spin around the mount, thin it with turpentine or *benzol*, if a solvent; or water, if it is a solvent of the medium. Then remove overplus of media with a scraper or a brush moistened in solvents, first with turpentine, finishing with benzine,* and patches of heavy muslin or linen wrapped double around a block of wood or cork about an inch square, with which the slide can be dried and polished, if mounted with balsam, damar, etc. When slides are mounted with Farrant's medium, gelatin, glycerin, etc., proceed in the same manner, using water instead of oily solvents. Strips of thick harness leather, three-eighths or one-half inch wide and three or four inches long, can also be used with advantage to remove moisture, and clean and polish slides.

Slides are thus easily manipulated into a neat condition to dry and harden, while avoiding the almost certain vexations of breaking or misplacing covers, or causing air-chambers in your mount while removing the hardened medium—a great drawback, and frequently the ruination of the most valuable specimens.

It sometimes happens that a slide is more or less daubed, the medium spreading over a greater part of the slide while the microscopist is removing air-bubbles. Inevitable fibres which fly through the room are bound to get into sections, and innumerable kinds of dirt which stare us in the face.

When the specimen is mounted, and a neat ring formed around it, the overflow or deluge of medium, sometimes unavoidable, is easily washed away with solvents, while fresh and soft, in the manner already described; but if laid away in such an unsightly condition to harden, it is much more difficult to remove and clean without ruining it. When plenty of medium is spun around the edge of the cover, it feeds the mount during the process of hardening. While the volume of medium is diminished through evaporation, a vacuum, or air chambers, is sure to form under the covers

* As benzine is highly explosive, or inflammable, I keep only a one-dram vial of it while using a lamp, and have no fear of using in this manner.

in spite of a flood of medium one side of the mount, if there is a scanty supply of medium on the opposite side, or unless the medium is very thick, when it requires considerable heat or pressure to get the covers down—a process which thin covers and frail or delicate specimens could not endure.

CLIPPING COVERS.

When it is necessary to use clips, I make them out of brass wire not thicker than No. 23 nor thinner than No. 25, Stubb's wire gauge, and bend it in the form of the letter U, so the shortest branch is from five-eighths to three-quarters of an inch long, while the other is a quarter inch longer. This is bent at right angles so as to stand upright, when both branches lie flat on a table. The other end should be bent so as to bear on the cover with its end transversely.*

These clips are very simple, and one can be made in twenty or thirty seconds. Clips two or three inches long must be made of heavier wire, from No. 20 to 16. It has been said that clips should have a large ring at the end to bear on covers, to keep them from springing, or getting dished on top. When the ring is about as large as the covers, and the specimen considerably smaller than the covers, as is frequently the case, the cover is just as likely to spring and get convexed on top; and as the medium contracts or shrinks more under the edge of the cover than in the center, this convexity is increased until the covers crack or separate from the medium. In either case the mount is ruined. When covers are slightly dished in clipping them, the unequal contraction of the medium under the covers will flatten them straight and even across the top—probably more so than those not clipped at all.

CENTERING AND RINGING CLIPPED COVERS.

I lay two strips of pasteboard on the turn-table for the slide to rest on, while centering the cover, and then spin the medium around the cover, which can be accomplished while the turn-table is revolving quite slowly, but not as perfectly as without clips; still it will be in a far better condition to lay away to harden, when centered, ringed and cleaned as well as convenience will permit. One painful sight is to see the covers on slides inclined like a shed roof. I have overcome this evil by moving the clip about on the cover on turn-table, till it would run as true as a top. They don't all remain so when hardened, but the most of them do, I think. Shed-roof covers on hardened slides can be levelled on the turn-

* The tension can be increased or diminished at pleasure by springing together or spreading them.

table with the clip and a gentle heat, and if level and centered when cold, they will remain so, if not neglected too long in ringing them with a strong cement.

CEMENTS.

A good cement to protect balsam, damar and all media which are soluble in oil solvents, is made out of a thick solution of gum senegal and gum arabic, equal parts dissolved, separately, in cold water, pure as possible, and strained† through closely woven muslin, and thoroughly mixed. To one ounce of this cement add three drops of carbolic acid dissolved in ten or fifteen drops of glycerin, chemically pure. Then add some more glycerin, without acid, and mix thoroughly with the cement, and in ten or fifteen minutes try some on a slide. In ten or fifteen minutes try it with a sharp-point knife; if it is hard and brittle, like hard balsam, add glycerin until it hardens in twenty or thirty minutes without brittleness, so that when you push the point of a knife through it, it will separate without breaking and flying away. It might be better to add glycerin till it takes a day to harden like cold beeswax.

Unless a sufficient quantity of glycerin is thoroughly mixed and incorporated with this cement, it will crack and separate from the slide. This cement should not be applied to balsam and damar mounts until they are sufficiently hardened to hold the covers. A second coat of this cement may be spun around the mount colored with anilin colors and ornamented with gold bronze, if desirable, after the first coat has thoroughly hardened, as well as the second coating. Too little time between each coating makes bad work—a painful experience, the result of trying to rush the mounts when pressed with too much other business. *Green* mounts ringed with this, or any aqueous cement, will soon be found full of little air chambers.

A beautiful pearl white cement is made out of this transparent cement, in the following manner: Pour a small quantity of the cement into a small mortar, and add sufficient Chinese-white (moist in tubes) and grind them thoroughly fine, and pack into a large-mouth bottle. Repeat this process until you have as much as you desire. This white cement, as well as the anilin cements just described, will not run in and ruin balsam or damar mounts, as white zinc or anilin cements soluble in oily solvents; *i. e.*, if the following rules are enforced:

First—The mount must be hardened so as to hold the covers without care.

† If too thick to use, thin with water.

Second—Spin two rings of the transparent gum cement around the edge of the cover, and give at least twenty-four hours' time to harden before applying the second coat.

Third—Apply as many coats of these white or colored cements as you like, but don't drown the mount with the first coat. Apply thin coats.

Fourth—Give at least twenty-four or thirty hours' time for each coat to harden.

Fifth—Ornament, if you wish, and in due time brush off the dust and give it a thin coat of a good finishing varnish, and give plenty of time to dry and harden before applying a second or third coat. I find Winsor & Newton's mastic picture-varnish to make the finest finish and is stronger and more durable than damar or shellac varnish, and is nearly colorless. I have not yet tried the new copal varnish. The enamel cement on page 95, Dr. James' *Elementary Microscopical Technology*, may be a good finishing varnish, and just the article for the body of the ring around the mounts of Farrant's medium, glycerin jelly, etc. A beautiful white cement for the mounts last mentioned is as follows: Add sufficient Cremnitz-white to mastic, or any good colorless varnish, or Brown's rubber cement, to give the required opacity, and mix them thoroughly. The white might be tried with Dr. James' enamel. This white cement is much stronger than white zinc, and does not assume the brick-red and dirty appearance so often noticed on white-zinc slides. I only use this white cement as a varnish to finish mounts; but never use it on balsam or resinous mounts, as it is liable to run in like white zinc. I have discarded white-zinc cement entirely as a nuisance. The best of it is too brittle in the start, and sooner or later crumbles or scales off. I don't trust glycerin as a mounting medium, as it is nearly impossible to keep it in a cell; furthermore, I have my doubts whether glycerin C. P. can be prepared to resist the action of germs on certain specimens without injuring or altering the form and appearance instead of preserving them, *e. g.*, biological or pathological specimens.

I am testing two kinds of media (my own preparation): Phosanalin, No. 2, 3, 4, 5 and 6, all soluble in any oily solvent, except No. 4; all to be a substitute for the balsams in general use without their objections—turning yellow and red, or a dirty appearance, brittleness, semi-opaque, crystalizing, crushing and distorting the cells of specimens in severe shrinkage, precipitations, lack of tenacity, etc.

The other medium: Hydro-crystal, No. 2, 3, 4, 5, 6 and 7, all

soluble in water and glycerin, except No. 7. The objections to Farrant's medium are: it soon colors from age, is not as clear and transparent as the resinous cements; it dries too slow.

I do not wish to recommend my media to microscopists until I have given them a satisfactory trial, and all slides that I have sent out can be returned if the media is unsatisfactory. Thus far none have been returned.

THE FINAL CLEANING OF SLIDES.

After the slides have been temporarily cleaned with spirits of turpentine and benzine and hardened, place them on a turn-table and moisten the slide with water on a brush, and hold a sharp brass, or iron scraper, on the slide while it is revolving rapidly, which loosens the thin film of the medium which the benzine could not remove around the mount. Scrape or loosen the rest without revolving the slide, which can then be cleaned and polished, or rubbed dry with strips of thick, solid harness-leather, one-half inch wide and three or four inches long, one end cut square at right angles and the two corners of the other end cut off to a point like the end of a knife-blade. When the ends get soiled wash them or shave them to get a fresh and clean surface of leather. The pointed end will then be in a good shape to clean and rub dry the covers moistened with water if soiled by using four or five of them. The leather can be kept clean and dried by rubbing their ends rapidly on a wollen cloth stretched over a board three or four inches square. One or two blocks covered with linen rags are also useful in cleaning and rubbing mounted slides to a dry polish after the scraper has been used with cold water. This scraper should be made of sheet brass, or heavy hoop-iron three-eights of an inch wide and four or five inches long, the ends and edges beveled sharp as a chisel. Steel might scratch the slides or covers, even if not hardened.

The scrapers should be kept sharp at all times with a sharp file. A polished slide can be held between thumb and finger without finger prints, by holding it between a clean piece of folded paper.

DOUBLE-STAINING ANIMAL TISSUES.

Kidney, lung, etc., may be double-stained beautifully as follows:

First, stain them in a solution of "Bengal blue," dissolved in distilled water, so that it will have a medium blue color when written on white writing paper with a clean pen. Give it several hours' time to dissolve, and filter.

Then make a red stain, as follows:

Put some ponceau (diamond dyes) into a clean, dry test-tube.

Warm it first, to drive out all moisture.* Then pour in absolute alcohol till the tube is one-third full,† and apply a gentle heat until it has a deep, blood-red color. Let it cool and settle; then pour off into a one or two-drachm vial, according to quantity in the tube, being careful not to get any of the undissolved dye into the vial, or you may filter it, incurring considerable waste. Then pour absolute alcohol into another vial till half full; then pour off the strong stain into the absolute alcohol until it has a medium red color when held to the light. Keep the vials tightly corked to avoid moisture, evaporation and dust.

Proceed to stain as follows:

First, immerse the section in the blue stain from two to ten hours until as blue as desired, when washed in clean water. Then dehydrate it thoroughly (alcohol cannot remove any of this stain or color), and float it on turpentine or essential oil. I think turpentine is just as good, and is much cheaper than the essential oils for general use. If the section is very frail, as sections of pig's lung, float it on to a cover-glass or mica in the turpentine, and lift it onto a slide, the mica between the section and slide, and apply the red stain in small quantities to the section with a camel's hair brush, keeping the specimen moist with turpentine, when the stain evaporates. Examine with the microscope as you proceed with the staining. If you see the stain is too weak when applied freely, add some of the strong stain to it until of right color. If section is overstained red, wash it out with absolute alcohol till the color is sufficiently removed. Then wash out any surplus of red stain or colored turpentine with fresh turpentine, and if there is any dirt to remove, taking some time to fish out, apply a drop or two of aniseed oil, which is the least volatile essential oil I know of. Then push the mica off the slide so as to grip it with the tweezers, and pull it away from the slide horizontally. Invert it and lay it on a clean slide, warmed, having plenty of balsam on it. Then hold the slide vertically and push the mica upwards off the slide so you can grip it with the tweezers and pull it off. If there is no objectionable dirt on it, lay a clean cover-glass on it and proceed as already described. The red stain can be made weaker by adding absolute alcohol to it, and stronger by adding the strong staining solution to it.

If sections are overstained in the blue stain, let them soak in plenty of distilled-water, or clean, soft water, from five to fifteen hours.

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* The vials, etc., should be as clean as possible, free of fibres or dust, and warmed to drive out all moisture, before putting absolute alcohol into them. The smallest quantity of moisture affects the beauty of the work.

† The alcohol spurts out when heat is too high and tube too full.

The skinny or membranous tissues and fat cells take the blue stain, while the muscles, etc., take the red stain, the various parts appearing red, violet, blue and green of various shades.

PALE COPAL VARNISH.

Pale African copal, 1 part; fuse; then add hot, pale linseed-oil, 2 parts. Boil the mixture until it is stringy, then cool a little, and add spirits of turpentine, 3 parts.

ANOTHER RECEIPT.—Dissolve 30 parts of pale copal and 2 parts of camphor in 120 parts of oil of turpentine and 30 parts of oil of lavender.

A BLACK ELASTIC VARNISH.

Burnt umber	120 parts.
Genuine asphaltum	60 "
Boiled linseed oil	3000 "

Dissolve the asphaltum in a small portion of the oil with the aid of heat; then add the umber, previously rubbed up with oil, and finally add the remaining oil. Mix the whole thoroughly, allow it to cool, and thin with oil of turpentine. This varnish is very elastic.

ALUMINIUM PALMITATE COPAL VARNISH.

Aluminium palmitate, a combination of aluminia and palmitic acid, is a resinous substance of remarkable properties, making it useful for many purposes in the arts. It melts at a higher temperature than damar and copal resins, and is easily soluble in oil of turpentine and benzine. A solution of one part of it in five of a solvent, retains a lacquer-like, thickly-fluid consistency. It never becomes brittle, but remains flexible and dries quickly. It has a silky gloss, bears an addition of any amount of damar and copal, obtaining thereby greater gloss, and depriving the latter two resins of their brittleness. It is entirely inodorous, and unaffected by water or dampness. It is recommended as a size for paper. This and pale copal, equal parts, or two-thirds copal, ought to make an excellent varnish for finishing slides. I have not yet tried it, but intend to.

ANY discussion of organic evolution must begin by assuming the existence of certain primordial forms of life. Whence came these forms? It can only be said that to this question science makes no answer. We have no knowledge of any natural process by which living organisms are created. But this question really forms no part of the general question of organic evolution. It must be remembered that evolution does not seek to explain the origination, but the formation of things.—*Stoller.*

PROCEEDINGS OF SOCIETIES.

THE SAN FRANCISCO MICROSCOPICAL SOCIETY.

THE semi-annual meeting of the Society was held at its rooms, 120 Sutter street, June 12, 1889, Pres. Payzant occupying the chair. Mr. A. H. Breckenfeld contributed to the evening's programme some fine specimens of *Melacerta ringens*, a tube-building rotifer, belonging to the family of wheel animalcules. This variety is considered the most beautiful of the species, and builds for its protection an ingenious tube, which it forms of round pellets that are elaborated in the interior of the animalcule, and securely gummed together with a secretion derived from the same source. This rotifer, when feeding, extends itself partly from its tube and by means of several rows of cilia produces a rapid rotary motion, one set of cilia drawing a current of water containing food to its mouth, while another row ejects the debris by a current produced in an opposite direction. The tube and occupant are highly transparent and viewed by dark ground illumination never fails to excite astonishment and wonder at the sagacity displayed by nature in protecting these minute organisms from their enemies and furnishing them with such elaborate means for obtaining their subsistence. Mr. Breckenfeld also exhibited a slide of *Æcidium* or "cluster-cup fungus," found infesting the scanty vegetation on Signal Peak, Yosemite Valley, some seven thousand feet above sea level.

Dr. E. G. Clark exhibited some interesting slides of Cinnabar ore in Chalcedony, showing free mercury, a rare thing in the natural state. The gentleman also showed a beautiful mounting of crystalized gold, displaying the peculiar fern-leafed disposition of the crystals produced by the galvanic current.

The most notable feature of the evening was the exhibition by Charles C. Reidy of his collection of old and rare works of the early writers on microscopy. To the student and all interested in micrographical literature this was an opportunity rarely offered to examine many volumes published by the pioneers in this branch of science, that are now very scarce. Mr. Reidy is devoted to the study of the Infusoria, and to facilitate his inquiries in that direction the present collection has been slowly accumulated, though not without great difficulty and perseverance, many of his orders for special works having been several years in the hands of European book dealers before they were obtained. The different volumes cover the entire field of microscopical research from its very beginning, and contain a complete résumé of the evolution of optical

science, together with the progress of mechanics as applied to the microscope. Many of the editions, in fact a majority of them, contain a high grade of illustrations, considering the date when they were executed, while some are embellished with fine-line copperplate engraving that would do credit to our own day. The oldest publications, belonging to the fifteenth and sixteenth centuries, are all bound in heavy parchment, and mostly written in the scholarly language of the time—Latin. The printing is remarkably good and legible, there being no perceptible fading of ink or paper. The authors represented were Adams, Baker, Baster, Bonanni, Descartes, Ellis, Eichhorn, Gleichen, Götze, Grew, Hill, Hooke, Joblot, Ledermüller, Leenwenhoek, Martin, Needham, Power, Redi, Scaäffer, Glabber, Smith, Spallanzani, Schott, Swammerdam, Trembley. Notable among these are Descartes' works, with numerous woodcuts, small quarto, Amsterdam, 1650. This work contains an illustration of Descartes' gigantic microscope eight feet high.

In the collection is Powers' "Experimental Philosophy, in Three Books, containing New Experiments, Microscopical, Mercurial, Magnetical," London, 1664. This last work is the earliest volume on the microscope in the English language.

Before adjourning a unanimous vote of thanks was tendered Mr. Reidy for his interesting exhibition of what is certainly the most unique collection of rare microscopical literature in the United States.

EDITORIAL.

THE AMERICAN SOCIETY OF MICROSCOPISTS.

AS PREVIOUSLY announced in THE MICROSCOPE, the next meeting of the American Society of Microscopists will be held in Buffalo, N. Y., commencing on Tuesday morning, August 20, 1889, and continuing four days. No other city could offer greater inducements for the gathering together of a large national organization of scientific men. Buffalo is centrally located as regards railroad facilities, possessed of active scientific and literary societies, well supplied with hotel accommodations and halls, and surrounded by beauties of nature which are of untiring interest to the zealous naturalist.

The President's circular will be issued this month, and from an advance copy we learn that the time set is the week preceding the meeting of the American Association for the Advancement of Science, which will be held this year in Toronto, Ontario. This

arrangement will be appreciated by those who are members of both organizations, as it will enable them to attend both meetings with no loss of time, and at a minimum expense, Toronto being accesible by both rail and water and but a few hours distant from Buffalo.

A feature of the August meeting will be an unusually fine display of instruments and accessories by dealers, special facilities for their exhibition having been arranged. This offers an exceptional opportunity to those members living at a distance from our large cities to become familiar with the comparative merits of European and American stands and the distinctive features of each.

The regular sessions will be held in the Buffalo library building, which is centrally located and especially adapted to the Society's requirements.

Those members of the Society who expect to present papers at the next meeting, and have not yet notified the Secretary, are asked to communicate with him at once, sending the title, and if possible a brief abstract of their articles, in order that the programme may be arranged in advance. Address Prof. T. J. Burrill, Champaign, Illinois.

It is urgently requested that members bring their microscopes with them for use during the sessions, and at the soiree. Arrangements have been made for the storage of instruments, on the check system, in the fireproof library building in charge of a competent person, where they may be obtained any time between the hours of seven A. M. and twelve P. M.

The local committee on hotel accommodations announce that reduced rates will be given members at the new fireproof hotel Iroquois. Rates at the Tift House and the Genesee are from three to five dollars per day, according to location of room. Arrangements have also been made whereby members may be accommodated in a large and well appointed boarding house, where good board and pleasant rooms may be obtained for one dollar per day, with extra accommodations at a slightly-advanced rate. Those wishing to take advantage of the special terms offered, are requested to communicate at an early day with the secretary of the hotel committee, Dr. Louis A. Bull, care the Buffalo Library Building, Buffalo, N. Y. All applications for accommodations should state how much the person is willing to pay.

The final detailed arrangement will be published in the August number of THE MICROSCOPE.

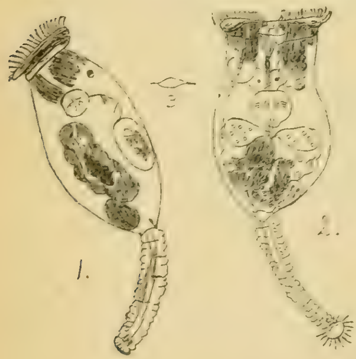
During the past year an extra effort has been made to get the Society on a satisfactory financial basis, and we are pleased to an-

nounce that all indebtedness has been cleared off, and the Society will convene in Buffalo with a balance to its credit. There are, however, a number of members still in arrears for dues and they are reminded that it is the annual dues on which the Society relies for its support.

ACKNOWLEDGEMENTS.—From Fred. Gaertner, M. D., Pittsburgh, Pa., slides of anthracotic tissue; from John Kruttschnitt, New Orleans, La., slides of vegetable tissue.

ZOOLOGY.*

SOME LITTLE-KNOWN ROTIFERS. (*Pterodina truncata.*)†—Dr. W. Barnett Burn says in regard to this rotifer that the late Mr. Gosse saw but one specimen of it, which he found in the "black sea" at Wandsworth, and assigns that the reason for its so seldom coming to notice is probably due to its habitat. It appears to live in a semi-parasitic state on the water wood-louse (*Asellus vulgaris*). He found four of these rotifers just in the central line, between the legs of the asellus, arranged in order, the front of each one to the head of the animal, and overlapping like scales. These never quitted their situation, and, what made it certain that they were in permanent quarters on their host, among the feet of the rotifers, but not attached in any way, there were three eggs, glued to the body of the asellus. One rotifer was on the side of the animal, and three others were swimming in the water, which they did in a graceful manner, not very quickly, but with ease, turning the foot from side to side, then coming to anchor and making their sucker a pivot, swimming round but soon moving off again. On being frightened, foot and head disappeared with great rapidity. This rotifer is most like a brachionus in the genus pterodina, being much thicker than the others, as is shown in the side view, Fig. 1. Moreover the organs go



*Under this heading will be included all Abstracts relating to the Embryology, Histology, etc., of Vertebrates and Invertebrates.

†Hardwick's Science Gossip, May, 1889, page 101.

more to the edge, as there is greater room there than in the other species, and, partly in consequence, it is not so transparent. Mr. Gosse says the eyes are small and transparent, but he figures them of a moderate size and red, and such Dr. Burn finds them to be. In the animal when closed, the edge is not everted, as in Mr. Gosse's figure, but as in Fig. 2, the occipital margin is thrown into a fold, and the pectoral has a slit. When the head protrudes, the fold is pulled out, the slit opens to a v-shaped aperture, and the edge becomes everted. The lorica in this genus seems more flexed than in others; as in *pterodina valvata*, the sides fold down like the "flaps of a pembroke table." The foot protrudes through an opening like Fig. 3, almost at the extremity of the lorica, quite different from the other species, in which it comes out near the middle.

BOTANY.*

THE DIATOM MARSHES AND DIATOM BEDS OF THE YELLOWSTONE NATIONAL PARK.†—Mr. Walter H. Weed contributes an interesting article on this subject, the result of his observations while prosecuting geological work in the National Park. Here the writer found diatom beds of recent origin, covering many square miles, in the vicinity of the geyser and hot-spring basins. These deposits, which are among the largest fresh-water diatom beds of contemporary age known, are still forming by the growth of diatoms in the warm water marshes supplied by the hot-spring waters. Near the Emerald Springs at the Upper Geyser basin of the Firehole river, the most noted geyser region of the park, there is a typical marsh of this character. The waters have in times past encroached upon the neigboring patch of timber, killing the pines (*Pinus murrayana*), whose bare gray trunks stand upright in the ooze or lie scattered about half immersed beneath the waters of the marsh. A subsequent half recession of the water has left a bare, white strip between bog and wood, on which vegetation has as yet a feeble hold, and the gaunt poles of the dead pines stand in a white powdery soil that is evidently a dried portion of the marsh mud. A large part of this bog is covered with a sparse growth of brackish water-plants, and the drier parts are grass-grown and form a fairly firm meadow bottom. The greater portion consists, however, of a semi-liquid, greenish-gray, dirty-looking ooze. Under the microscope this was found to consist of various diatoms, in which the Rev. Francis

*Under this heading will be included all Abstracts relating to the various departments of Botany.

†Botanical Gazette, May, 1889, page 117.

Wolle has identified the following species: Denticula valida, Denticula elegans, Navicula major, Navicula viridis, Epithemia argus, Epithemia argus var., Amphicephala, Epithemia hyndmannii, Cocconema cymbiforma, Achnanthes gibberula, Mastigloia smithii, Fragillaria. The first named species was the most abundant, forming the bulk of the specimen. The white pulverulent material at the margin of the bog proved to consist of the dried remains of these same diatoms, and it is quite evident that this diatom ooze is forming a bed of diatomaceous earth. Subsequent investigation shows that a diatom ooze, consisting of the same species forms the chief constituent of similar marshes all over the park. It has also been found that the meadows of the geyser and hot-spring basins were once marshes of this character, and are underlaid by beds of soft straw-colored or gray material which consists of the partially dried remains of diatoms. This material when dried is white, loosely coherent, soils the fingers, and consists either entirely or very largely, of diatom tests. These diatom beds cover many square miles in the vicinity of active or extinct hot-spring vents of the park, and are often three feet, four feet, and sometimes five to six feet thick.

MEASUREMENT OF POLLEN.*—Prof. Byron D. Halsted, has measured forty-one kinds of pollen taken from twenty orders of plants, and finds that not only is there a considerable difference in range of size of the grains, but that in measuring, the condition of the pollen, that is, whether it is dry or wet, must also be considered. Pollen when dry, that is, freshly taken from the dehisced anther, shows some things not seen in the same when wet. Of course, the natural shape of the pollen is destroyed by the wetting process. Many grains have characteristic folds which are lost from view when liquid expands the coats. Only one of these folds is usually seen in side view, but by looking at one end there are usually three observed. Some grains, like many kinds of mint pollen, are flat; that is,somewhat flax-seed shaped. In *monarda fistulosa*, for example, the grains are $\frac{5}{5}\frac{5}{6}\mu$ x. $\frac{6}{6}\frac{4}{7}\mu$ when viewed flatwise, and each grain is traversed by three folds, making the grain resemble a miniature muskmellon. When water is added the grain changes its shape with surprising rapidity, the longer diameter becomes the shorter and the shorter the longer, with little variation in the original figures. Dry pollen has the outer coat uniform, while in the wet grains there may be broad belts or lines of a different exterior. The pores are not usually so evident in the dry pollen as when they are wet. It is

* Bull. Torrey Botan. Club, May, 1889, page 135.

more difficult to get a satisfactory measurement of a dry grain, as it may be partly collapsed or the light so broken that no distinct outline is seen. It seems evident therefore that the full and perfect measurement of a pollen grain requires that it be taken twice; once when dry, that is, in the condition when ready for passage from dehisced anther to stigma, and again when fully swollen by imbibition of water, and both figures should be given with conditions for each.

MICROSCOPY.*

MOUNTING FRESH WATER ALGÆ.†—Klein uses Migula's process. A drop of one per cent. osmic acid is run under the cover-glass and in ten to twenty minutes afterwards glycerin is added. In order not to blacken the oil drops, etc., the osmic acid is added in as small quantities as possible, and this is best done by blowing it under the cover-glass through a capillary tube. In all other cases the author uses glycerin-gelatin, which with the proper precautions, is an excellent embedding material. The object is first hardened by exposing it as a hanging drop to the fumes of the acid for a few minutes. It is then placed in one or two drops of dilute glycerine, and the surplus having been drained off or the water evaporated, a drop of glycerin-gelatin, previously heated in a test tube, is dropped on by means of a fine glass tube. By this device air bubbles are avoided.

PATHOLOGY.‡

ETIOLOGY OF DIPHTHERIA.—If we compare the streptococcus diptheriæ with those species of bacteria already known and fully described, we find that, in its form and in its modes of growth, as well as in its effects when injected beneath the skin or into the blood of animals, is appears to be identical with two well-known species, called streptococcus pyogenes, and streptococcus erysipelatos. I have carried the cultures of streptococci from cases of diptheria, along side by side with cultures of streptococci made from various cases of simple acute erysipelas, and simple phlegmonous inflammation, week after week. Over and over again I have stained, measured and compared the growth from these three sets of sources, I have repeatedly inoculated duplicate sets of animals with the

*Under this heading will be included descriptions of New Instruments, Microscopical Manipulations, Stains and Re-agents, Photomicrography, etc.

†R. M. Jour. from Hedwigia, 1888, pp. 121-6.

‡Under this heading will be included all Abstracts relating to the Histology of Diseased Tissues, both Animal and Vegetable.

different cultures, and I have never found a single appreciable constant feature of difference between them. There are, it is true, often differences in rapidity and vigor of growth on artificial culture media, as well as differences of virulence, as the result of inoculation of animals, between cultures derived from the different sources. But these differences are no more marked between cultures from erysipelas, phlegmon, and diphtheria than those often observed between cultures derived from different cases of the same disease.—*Prudden.*

NICOLAIER'S TETANIC BACILLUS.—Kitasato,* of Tokio, Japan, after a series of experiments, has finally succeeded in obtaining pure cultures of Nicolaiers bacillus of tetanus. The tetanic bacillus is a true anærobic bacillus. K. found that a mixed culture which had been kept in a temperature of 97° F. contained the most Nicolaiers bacilli. He therefore subjected it for some time to this temperature, and the culture being then in full development, he placed it in a water-bath at 176° F. This temperature kills all adventitious microbes, but allows the tetanic bacillus spore to live. After this partial sterilization the plate culture is maintained at a temperature of 64–70° F., in an atmosphere of hydrogen. With the pure culture thus obtained K. was enabled to produce tetanus in rats, Guinea pigs, and mice. Nicolaiers bacillus resists heat very well, and must be exposed five minutes to a temperature of 212° F. to be killed. A most curious fact, however, is that the bacillus disappears very rapidly in the blood, apparently producing ptomanes,—but this remains to be demonstrated.

THE ETIOLOGY OF SCARLET FEVER.†—Dr. Marié Raskin, of St. Petersburg, who has investigated the subject, finds that Klein's micrococcos scarletinæ is a streptococcos identical with the S. pyogenes. Edington's bacillus was found in cnly four case out of one hundred. A new and hitherto undescribed micrococcus, having an irregular form and varying in size, was found, however, in every case. This micrococcus grew well in culture of agar or gelatin. Whenever it appeared in pairs one was always larger than the other. The organism was found in the blood, parenchymatous organs and in flakes of the patient's skin. It was only found in the blood during the first four days of the disease, and was always enclosed in the leucocytes.

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*Philadelphia Medical News, June 22, 1888.

† centralblt, f. Bakt, a. Parasitk, May 10, 1889.

MISCELLANEOUS.

CONFLICT BETWEEN A ROTIFER AND INFUSORIAN.—R. P. Grace describes in Science Gossip an interesting encounter between a rotifer (*Brachionus rubens*) and an infusorian, which he was so fortunate as to witness. The infusorian began the attack by turning slowly and gently around the rotifer's foot for some time, and then more rapidly. This appeared to cement the rotifer's foot to the glass. The rotifer lashed about with great vigor in his efforts to escape, but was unable to get away. The enemy was repulsed many times, but returned to the attack, until about half an hour the rotifer became exhausted. The infusorian then attempted to enter the lorica, but being much larger than the opening it resorted to the following device to accomplish its purpose: The front part of the infusorian was drawn out into a mere ribband, while the contents of the animal were pressed backward, thus forming a globe. The ribband was then inserted through the lorica and when in, the contents of the globular portion flowed into the ribband, leaving a thin projection behind. Once within its host, the infusorian assumed a globular form and rotated itself. The rotifer's intestines first disappeared, the brain and eye last. The rotifer's cilia moved rapidly for quite half an hour after the entrance of the enemy. Having devoured its host the infusorian divided into two or four new animals, which were exactly like the parent, and swam swiftly away to seek fresh victims.

THE MICROSCOPIC FAIRYLAND.—"I gaze into that wonderful world which lies in a drop of water, crossed by some atoms of green weed; to see transparent living mechanism at work, and to gain some idea of its modes of action; to watch a tiny speck that can sail through the prick of a needle's point; to see its crystal armour flashing with ever-varying tint, its head glorious with the halo of its quivering cilia; to see it gliding through the emerald stems, hunting for its food, snatching at its prey, fleeing from its enemy, chasing its mate (the fiercest of our passions blazing in an invisible speck); to see it whirling in a mad dance to the sound of its own music, the music of its happiness, the exquisite happiness of living—can any one, who has once enjoyed this sight, ever turn from it to mere books and drawings, without the sense that he has left all fairyland behind him?"—*Dr. C. T. Hudson, President's Address, R. M. S.*

NEWS AND NOTES.

PROTOPLASM!

Take the microscope and look
  Down on any living tissues,
Lo! before you, like a book,
  Lies the cell; and from it issues
Others, and in all we trace
  Viscous globules, each one has 'em
You're of life the very base,
  Protoplasm!

If I take a single drop,
  You're in such a strange condition
That your movements never stop,
  As if guided by volition.
Ardently we watch your whirl,
  Science breeds enthusiasm;
You're as giddy as a girl,
  Protoplasm!

Every blade of grass, each flower,
  All that owns a life organic,
Every man that lives this hour,
  Boasting of his thews Titanic;
Looking backward, we can see
  Over life, as o'er a chasm,
How all sprang at first from thee,
  Protoplasm!

Thus it seems to thee we owe,
  All we are and all we may be;
Man, the microscope says so,
  Was a protoplastic baby.
Here's your health, then, since you bring
  Life, that physiologic spasm;
But for thee I could not sing,
  Protoplasm!

H. Savile Clarke, in St. James' Gazette.

THE so-called black snow which fell at Aitken, Minn., on April 2d, showed on microscopical examination to consist of fine particles of dirt, some of which had a metallic lustre.

MESSRS. QUEEN & CO., of Philadelphia, have issued a circular offering the services of their agents in Paris and other European cities, to all intending visitors to the exposition, and purchasers of scientific apparatus.

BOOK REVIEWS.

THE RADICAL CURE OF HERNIA. By Henry O. Marcy, M. D. Paper; pp. 238. Geo. S. Davis, Detroit, Mich. Price, 25 cents.

This work is a resumè of the experience of one who has devoted much attention to the subject and who has done not a little to the advancement of our knowledge of hernia. It contains many new data not hitherto published and is well worthy the perusalof all interested in surgery.

CORRESPONDENCE AND QUERIES.

DESPERES, St. Louis Co., Mo., May 29, 1889.

EDITOR MICROSCOPE:

Some time ago a writer declared it impossible to examine unmounted objects in fluid with an inclined microscope. Yet I have done this impossible thing for years. I always keep on hand a number of rubber cells of all sizes, shapes and depths, cemented to glass slips with gold size. In examining an object, I fill a cell with the resp. fluid, put the object in it, and cover it with thin glass *overlapping* the cell. Superfluous fluid is removed with blotting paper, and your object is ready for examination in any position of the microscope. Moreover you may keep the object. I kept one in glycerin for one year and then mounted it permanently in the same fluid. In doing this, I always use a cover of the exact size of the *outside* diameter of the cell, and am never troubled with cement running in, or air bubbles.

For illumination, I use the Acme lamp of Queen & Co., with stand and color-correcting glasses. Microscope and lamp are fitted to a board so that both may be taken off at once. The lamp may be slid on the board in a straight line, and the microscope turned concentrically on its base. To exclude the glare of the lamp, I fitted pasteboard shades to it. This lamp saves me a condenser or stand, and is more conveniently used than the latter. The other lamp is a night lamp of the same size as the Acme, and is used to allow one to arrange or dissect objects. This lamp is covered with a pasteboard tube, when using the microscope, thus doing away with all diffused light.

Microscope and Acme lamp when not in use are covered with pasteboard boxes made by myself. They are more convenient than glass shades and cost me nothing.

Yours respectfully, PAUL W. GAYER.

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16. Where may the Pinnefore lamp mentioned on page 139 of THE MICROSCOPE be obtained? V. A. L.

16. (ANS.)—The Pinnefore lamp burner to which I referred on page 139 of THE MICROSCOPE for May is for sale at all the leading lamp stores. It is used in many of the street cars of this city and gives a very bright light. The burner can be supplied with bowl, shade, etc., to suit the taste of the purchaser. The outfit I described is for class-room use. Other combinations may be more convenient for special use, but I doubt if a more serviceable burner than the Pinnefore can be found in the market.

ST. LOUIS, June, 1889. H. M. WHELPLEY.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS *who have microscopical apparatus material or books which they wish to exchange, and such wants will be* INSERTED FREE OF CHARGE. *The number of insertions given will depend upon the number of exchanges received each month. Subscribers will please notify us when articles have been exchanged or sold. Dealers are referred to our advertising department.*

TO EXCHANGE -Vols. V and VI of THE MICROSCOPE, which I will sell for $2.50 and take cover-glasses as pay—½ and ¾, and some square.

A. MILLER, North Manchester, Ind.

FOR EXCHANGE—A Hailes "Poly-Microtome" (an automatic microtome for freezing or paraffin-embedding), in exchange for a Kodak camera, or other good "detective."

C. E. HANAMAN, Box 27, Troy, N. Y.

WANTED—A copy of each of the following numbers of *The Microscopical Bulletin*, Vol. I, No. 5, August, 1884, and Vol. II, No. 1, February, 1885. For either of them, I will send a first-class microscopic slide, or for both I will send three slides

M. S. WIARD, New Britain, Conn.

FOR SALE CHEAP—A Bausch & Lomb Universal Microscope complete, with objectives and accessories, perfectly new. Address

PROF. C. F. EMERY, Ocean Springs, Miss.

WANTED—Vols. I to VI of THE MICROSCOPE. Apply, stating price, to this journal.

FOR EXCHANGE—A large variety of minerals and rocks, some polished; also fossils and reptiles in fluid, for mounts. Address,

PROF. J. E. TALMAGE, Salt Lake City, Utah.

FOR SALE—First-class duplicate objects, five for $1. You can get your objects in and class you may name, except pathological; but no time for lists. If you do not get $1 worth, money will be returned on day after slides are returned.

E. C. HOYT, 215 Howard St., Detroit, Mich.

FOR SALE—Vols. IV, V, VI, VII, of THE MICROSCOPE, bound in two volumes; fourth edition of Wyeth's "The Microscopist;" Marsh's "Section Cutting," and Phin's "How to Use the Microscope." For cash only.

H. M. RICHARDS, 27 Ellery St., Cambridge, Mass.

FOR SALE—A Bausch and Lomb Model Microscope (No. 521 of their catalogue), as good as new, having been used but a few times. There are two objectives, a 1 inch and a ¼ inch, one 2 inch eye-piece, camera lucida, etc. Everything in perfect order. Will be sold cheap. Correspondence solicited. Address,

S. G. ROBBINS, Siverly, Pa.

WANTED—THE MICROSCOPE, Vol. I to VI inclusive.

W. E. SWIGERT, Spencer, Owen Co., Ind.

WANTED—Several good objectives and eye-pieces; must be in first-class condition. State full particulars. Also want unmounted material. Will exchange or buy. Correspondence invited. CHAS. VON EIFF, 20 Palmetto St., Brooklyn, N. Y.

WANTED—Histological and pathological material to cut on the halves. Nothing but first-class material desired. Address C. B. CLAPP, M. D., Danville, Ill.

FOR SALE—Choice slides of encysted trichina spiralis in muscles of cat, with cystic plexus of capillaries injected red; very fine. Write at once for these novelties.

FRANK S. ABY, Iowa City, Iowa.

RARE MOUNTS for sale or exchange: hair of *Ornithorhynchus paradoxus*; mummy cloth, three thousand years old; sections of bark from Charter Oak tree. Address

PROF. H. M. WHELPLEY, St. Louis, Mo.

FOR EXCHANGE OR SALE—For microscopical materials or offers: A good Toepler-Holtz Electrical Machine, 12½ inch revolving plate, and current breaker, Leyden jar, Geissler tubes and numerous other accessories, the whole costing about $60 Will exchange for a good microscope, and pay difference. Correspondence solicited.

F. F. WOOD, Prin. Blair Graded School, Blair, Wis.

FOR SALE—A B. & L. Section Cutter, glass top, and micrometer screw, in perfect order, good as new, cost $7.50; will sell for $5.

H. F. WEGENER, 1305 S Tenth St., Denver, Col.

THE MICROSCOPE.

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ORIGINAL COMMUNICATIONS.

THE LEAVES OF CATALPA AND PAULOWNIA.

DR. ALFRED C. STOKES.

TO BE able to recognize the trees and to call each by its name as it stands, leafless and apparently dead, by the roadside or in the sombre forest, is a task that demands a wonderful amount of previous observation and careful study. Although the branches and the spray may be never so sharply defined against the sky; although the tree may be a familiar acquaintence when in leaf, in flower, or in fruit, only let it stand with its twigs and branches naked to the wintry winds, and he is an observing student who can call it by its name. Yet the skeleton tree of the winter is as characteristic as the same tree when clothed in all the greenery of its summer foliage. And how many among us amateur botanists can look even at that summer leafage and salute the tree by its proper title? We may, perhaps, be on familiar terms with the carices, although that is a little doubtful, or we may know even the asters and the wild roses, yet the trees are often strangers to us. With the exception of a very few whose stems may be characteristic, like those of the birch or the sycamore, or whose method of growth may be distinctive, as that of the weeping willow, the others shield us from the sun and the wind, while we habitually ignore them.

The power of observation does not seem to be great in the average human being. To cultivate the little which each of us possesses demands care and attention. I have recently been much amused in this connection and at my own expense. I traveled southward a thousand miles to see a cypress tree with the curious "knees" that

grow about the conical base, and I carried one of those excrescences a thousand miles to show it to my friends, only to find that a dozen cypress trees, knees and all, were flourishing within half a mile of my own front door. Some of these I had passed almost every day for a dozen years, yet had never seen them. But who could see through a hemlock hedge? It was Thoreau, I think, who intimated that he did not need to travel in search of rareties, for he expected to find even the *Victoria regia* in Walden pond.

The study of the trees is a science worthy of a place by itself; it might justly be separated from that of the smaller and humbler phænogams and flowerless plants, aud the amateur who should devote himself to the pursuit would find it an entrancing one, whose attractions neither the cold of winter nor the heat of summer could diminish. And when he could do no more than name the tree from the aspect of its naked branches, or from a glance at its leaves, he would be a botanist indeed.

If there are few who know our trees in the winter, are there many more who can recognize them by their foliage in the summer? The flowers or the fruit may divulge the secret, but the leaves alone add for most of us who are fond of botanical study, an element that more frequently than not gives us trouble. And again it sometimes happens that the leaves of two trees generically distinct, or even members of distinct orders, may be so nearly alike in form, size, texture and general appearance, that we can only say that one leaf is from one of two trees, and that the other may also be from one of two trees, but further and with more definite statements we dare not venture.

Then the microscope may came into use, although it may be nothing more than a pocket-lens, for Nature is not so limited in her resources that she is compelled to make the leaves of distinct genera exactly alike, however they may appear to the naked eye. This fact and the usefulness of the pocket-lens in the discrimination, have recently become prominent in my own experience in connection with an effort to identify the leaves of *Catalpa bignonioides*, Walt., and those of *Paulownia imperialis*, Lieb., when removed from the trees.

These trees belong to distinct natural orders, *Catalpa* to the Bignoniaceæ, *Paulownia* to the Scrophulariaceæ, yet I do not believe that any amateur botanist, and I feel considerable doubt as to the ability of the professional, positively to distinguish the leaves of the one from those of the other, unless he knows the microscopical secret, even when the two trees are standing side by side, provided that each is deststute of flowers and fruit. Both trees, at least in the

eastern part of the country, are rapidly becoming common wayside ornaments. Consequently there need be no difficulty in making the experiment. The *Catalpa* is said to be a native of the Southern States, but it has successfully adapted itself to the climate of our northern and eastern regions, where it grows rapidly and is happily becoming more abundant every year. The *Paulownia*, it is stated, was introduced from Japan and first used as an ornamental tree in parks and large private grounds. It, too, is cheerfully adapting itself to the exigences of our remarkable climate, and is fast becoming a wild plant, springing up in unexpected places. The winged seeds of both trees fly lightly on the wind, and their mature or even their young products resemble each other in general appearance and, when the flowers and fruit have fallen, may readily be mistaken the one for the other.

The leaves of *Catalpa* are described as "opposite, simple, petiolate, ovate-cordate, acuminate, subentire and pubescent beneath;" those of *Paulownia*, as "opposite, petiolate, broad cordate, above entire or somewhat trilobate, villous-pubescent both sides, smoothish above when full grown"—the differences seeming to be almost as great as those between tweedle-dum and tweedle-dee. Both trees, as uncultivated plants by the roads and waysides, are more then welcome, but to recognize them by their leaves is, I believe, an impossibility without the use of the pocket-lens; but after the microscopical secret has been learned, the characteristic points may be distinguished by the naked eye, and the origin of even the youngest leaves readily determined.

THE YOUNG LEAVES OF CATALPA BIGNONIOIDES, WALT.

There are two classes of appendages to be examined, hairs and glands, both of which are here abundant.

The youngest leaves have the upper surface thickly studded with minute, hemispherical, sessile glands which, to the naked eye, give the part a silky aspect. These quickly disappear as the leaf becomes older and larger, leaving the surface smooth when viewed with the pocket-lens. A quarter-inch objective discloses innumerable, minute, colorless hairs, to which the peculiar glossy appearance may in some part be due.

The entire lower surface is downy, with colorless, variously curved but wholly unbranched hairs, mingled with minute, sessile glands similar to those on the upper surfaces. The prominent veins are especially villous, and the petioles of the youngest leaves are both downy and glandular. From the petioles these appendages soon disappear, leaving them smooth and glossy. To the lower surface of

the leaf the hairs cling longer, but sooner or later they, too, disappear, leaving only the sessile little glands, which in time also take their departure. From the prominent veins, however, the hairs and glands are never wholly eliminated. There is always a conspicuous fringe along the lateral borders, while in the axils the glands become clustered and partially embedded in a characteristic manner.

The young leaves of *Catalpa* are minutely glandular above, and beneath densely silky-villous with hairs which are variously curved but entirely unbranched, and in no way glandular.

THE YOUNG LEAVES OF PAULOWNIA IMPERIALIS, LIEB.

Trees, shrubs and herbs with variable leaves are not infrequent, those on the same plant sometimes differing so widely in form that they might readily be mistaken as the product of distinct species, if their source was not definitely known. A tree somewhat frequently met with in the neighborhood from which I write, the paper mulberry, *Broussonetia papyrifera*, is an instance of this. Its leaves are noted for their variable forms, some being almost entire, while others are most curiously and irregularly lobed, thus giving the tree, when in full foliage, a somewhat startling appearance. But if similar variability is not uncommon, it is rare to find the leaves of the same tree varying in the form of their epidermal appendages, so far, at least, as their hair-like covering is concerned. There are probably instances in which different leaves of the same tree bear both simple and branching hairs, but with the exception of those of *Paulownia*, these instances have not come to my knowledge.

It is a curious and a useful diagnostic feature of the *Paulownia* leaves that some are densely clothed with simple, unbranched hairs, each tipped with a little glandular bulb, while others on the same tree are still more densely woolly with copiously branching appendages, that are not in the least glandular.

There are consequently two kinds of *Paulownia* leaves to be observed. In the young of both forms each surface is densely villous with hairs and glands, but the hairs and glands of one variety are united, the latter being minute spherical tips to the former, this combination also extending to the petioles. On the same tree, often by the side of the preceding, the other form exhibits leaves whose lower surface especially is like dull-white velvet, by reason of the abundance of its hairy covering. The hairs are not glandular tipped, but beautifully and indescribably branched, somewhat like those on the leaves of the common mullein, *Verbascum Thapsus*, L.

Irregularly distributed over the surface of both these forms of *Paulownia* leaves there are colorless, cup-shaped glands distinctly

visible with a pocket-lens, and when once seen, then easily apparent to the unaided vision. These are characteristic and diagnostic of all the leaves on the tree. A suggestive fact is that these cup-shaped bodies are found chiefly upon the prominent veins on the lower surface of those young leaves, whose hairs are unbranched and glandular-tipped, and on the upper surface of those supplied with the branching appendages. In the latter, the lower aspect is so densely woolly, the branching hairs are so abundant and so crowded that no room is left for the development there of the little cups. These, apparently as a necessity, have been relegated to the less villous upper surface.

THE OLDER LEAVES OF CATALPA BIGNONIOIDES.

As the leaves increase in size and age, their upper surface loses its supply of sessile, hemispherical glands and, under the pocket-lens and to the naked eye, appears entirely smooth, the petioles also becoming naked and glossy. The lower aspect, however, becomes characteristic. Here the cuticular surface gradually loses its supply of simple hairs, which finally entirely disappear from every part, except from the margins of the largest and most prominent veins, where they are always to be found more or less abundantly. With almost equal deliberation there are developed, chiefly in the angles formed by the divergence of the larger veins from the midrib below, glandular structures which are of diagnostic value in determining the leaves of the *Catalpa*, and which at once differentiate the old or mature foliage from that of *Paulownia.*

These axillary appendages are fleshy, glandular scales formed of colorless or greenish, flattened or hemispherical glands, which may at almost all times be seen sitting singly at the margins of the midrib and above the glandular mass within the axil below. These and the fleshy scales are always visible to the naked eye. The included, and the isolated glands as well, are often flattened, especially when the secretion which elevates their upper surface, has exuded, but they never become cup-shaped, and very rarely a few isolated hemispheres may be seen on the upper cuticular surface if carefully searched for. The axillary scale appears to be formed by a thickening of the epidermis of the midrib and of the leaf, the fleshy growth finally embedding and partially burying the glands in its substance, while the thickening itself eventually becomes glandular.

THE MATURE LEAVES OF PAULOWNIA IMPERIALIS, LIEB.

Some of the books state that the mature leaves of *Paulownia* may be distinguished from those of *Catalpa* by their larger size. This distinction may be good in theory, but it fails in practice. The

two cannot be separated by their dimensions. This must be done by the form and structure of the epidermal appendages.

Here the colorless, cup-shaped glands already referred to, are diagnostic. They are always present on the mature *Paulownia* leaves, sometimes upon the upper surface, sometimes upon the lower, occasionally on both. On the upper aspect they are usually most abundant about the region near the base of the leaf where the large veins meet to enter the petiole. Here they are clustered in a quite conspicuous patch of little cups. On the lower aspect they are to be found attached to the cuticle of the large veins, often on the lateral margins, while they are also noticeable sparingly scattered over the basal portion of the general surface.

When the young leaves are villous with glandular-tipped, unbranched hairs, these remain, although they become less abundant as the leaf increases in size and age ; they never entirely disappear. Those on the general lower surface usually diminish somewhat in size as well as in numbers, while on the veins they retain most of their original characters. The same conditions obtain, to a certain extent, with the copiously branching hairs found on many of the leaves. These remain in some profusion on the general cuticle, while on the veins, glandular hairs are usually developed, as the touch will demonstrate.

The hairs, however, are of less diagnostic value on the mature foliage than the cup-shaped glands. The same holds true with *Catalpa*. If the colorless, cup-like appendages are present on either surface of the leaf, or on the petioles, the leaf is from the *Paulownia*; if the fleshy, glandular scales exist in the axils of the veins below, the leaf is from the *Catalpa*. With the young leaves the hairs must be studied, as the glands are then, on both trees, entirely undeveloped or obscure.

The following recapitulation condenses the matter into the form of a key or analytical table :

RECAPITULATION.

Ovate-cordate leaves known to be from either *Catalpa* or *Paulownia* (*A*).

A Leaves young or immature (*B*).

A Leaves mature (*C*).

B Lower surface villous with unbranched hairs, not glandular-tipped.. *Catalpa.*

B Lower surface villous with unbranched hairs, glandular-tipped ; a few scattered cup-shaped glands on the veins, *Paulownia.*

B Lower surface densely white-woolly with copiously branching

hairs ; upper surface with branching hairs and scattered cup-shaped glands . . . . *Paulownia.*

C Axils of the veins below bearing a fleshy, glandular scale ; margins of the veins with unbranched hairs, not glandular-tipped, *Catalpa.*

C Axils of the veins below, or the cuticular surface above, or both, bearing numerous cup-shaped glands (*d*).

D Veins and cuticular surface below with unbranched hairs, glandular-tipped . . . . *Paulownia.*

D Veins and cuticular surface below with branching hairs, not glandular-tipped ; cup-shaped glands, chiefly on the upper surface,

TRENTON, N. J. *Paulownia.*

THE BACTERIOLOGICAL HISTORY OF PNEUMONIA.*

[Being a Part of the Chairman's Report of the Section on the Practice of Medicine.]

WILLIAM B. CANFIELD, A. M., M. D.,

CHIEF OF CLINIC FOR DISEASES OF THE CHEST, UNIVERSITY OF MARYLAND, ETC., BALTIMORE.

THE pathology of the disease ordinarily called pneumonia, is by no means clear. Ever since investigators have begun to classify diseases from a different point of view, and to find out the exciting cause or organism which causes that particular disease, the subject of pneumonia has been the object of much study and speculation. From a clinical aspect, observers had noticed that pneumonia occasionally occurred in epidemics, and that "catching cold" did not always seem to account for its outbreak, as was evidenced principally in the immunity of sailors, who lead exposed lives.

The literature of this subject is so extensive, and has increased so much in the last few years, that I shall only consider it hurriedly. Klebs,† Eberth,‡ Koch,§ Salvioli,‖ Zäslein,¶ Talamon** and others had found and described organisms in the lungs, pleura and kidneys of man, but Friedländer†† was the first to describe what he supposed was the specific organism. It was a short bacillus, or, as he called it, coccus, surrounded by a zone, or capsule. He cultivated it

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*Read before the Medical and Chirurgical Faculty of Maryland at its Ninety-first Annual Meeting, April 24, 1889.

† Archiv. f. Exp. Pathologie, Bd. IV, 1877.

‡ Deutsches Archiv. f. Klin. Medicin, Bd. XXVIII, 1881.

§ Mittheilungen aus dem Kais. Gesundpheitsanet, Bd. I, 1881.

‖ Arch. per le Scienze Med., Vol. VIII, 1884.

¶ Centralblatt f. d. Med. Wissenschaften, 1883.

** Progrès Médical, 1883.

†† Fortschritte der Medicin, 1883, S. 715.

and was able to produce pneumonia in mice, but not in rabbits. His pneumonococcus, as he called it, was for several years looked upon as the specific organism of pneumonia. Fränkel,* Weichselbaum,† Gamaleia ‡ and Sternberg § in this country, have done the most important work in this direction up to the present time.

It seems that in September, 1880, Sternberg,|| while engaged in certain investigations in New Orleans, injected a little of his own saliva beneath the skin of a rabbit as a contral experiment. To his surprise, the animal died, and in the blood was found a multitude of micro-organisms in pairs and chains.

In 1881 Pasteur,¶ in examining the saliva of a hydrophobic patient, injected some of it into a rabbit, and obtained similar organisms. Later, Fränkel ** followed out the same line, and concluded that this organism, which he called a diplococcus, was the specific organism of pneumonia, although he found occasionally other organisms present, and among these, at times, Friedländer's. Weichselbaum †† reviewed the whole work and repeated the experiments, with no exact and definite results. He could not confirm any one specific organism, but thought the diplococcus was most frequently present in pneumonia, although he could not help thinking that several organisms might enter into the causation of pneumonia. Gamaléia ‡‡ described the organism studied by him as the *Streptococcus lanceolatus Pasteuri.* He concludes that it is always found in fibrinous pneumonia in man, and that it can be demonstrated experimentally; it produced in animals partially refractory to the virus, as the dog and sheep, a fibrinous inflammation of the lungs, but its pathogenic influence is held in check in those who are healthy by the action of the pulmonary phogocytes.

J. Lipari §§ reproduced pneumonia in animals by intratracheal inoculation of pneumonic sputa, or of cultures of an organism having all the characteristics of Fränkel's diplococcus. In all cases he found the same organism in great abundance in the hæmorrhagic and sero-fibrinous pleural exudations, and in the hepatized pulmonary parenchyma, less abundant in the blood and spleen, inconstant

* Centralblatt f. Bacteriologie u. Parasitenkunde, Bd. I, S. 78, 79. Zeitschrift f. Klin. Med., Bd. X, S. 401. Deutsche Med. Wochensdirift, No. 13, 1886. Zeitschrift f. Klin. Med. Bd. XI, A. 5 and 6.

† Centralblatt f. Bacteriologie u. Parasitenkunde, Bd. I, S. 297, 553, 587.

‡ Annales de l'Institut Pasteur, t. II, No. 8, 27 Aout, 1887.

§ London Lancet, March 2, 1889. New York Medical Record, March 16, 1889.

|| Journal of the Royal Microscopical Society, June, 1886, p. 396.

¶ Comptes Rendus, t. 92, p. 159.

** Loc. citat.

†† Loc. citat.

‡‡ Loc. citat.

§§ Il Morgagin, October, November, December, 1888.

Fig. 1.

PLATE IX.

in the liver, kidneys, and pericardial and peritoneal fluids. In some cases of pericarditis, peritonitis and abscess of the liver, the diplococci were very abundant. Inoculations of sputa, or of pure cultures in their veins, in the peritoneum, or under the skin, never caused pneumonia; pneumonia occurred only when the inoculations were made through the lungs. The disease was first local, and then became general.

The most recent review of this subject has been made by Sternberg.*

Most writers agree as to the identity of the *Micrococcus Pasteuri* (Eteneberg), *Streptococcus lanceolatus Pasteuri* (Gamaléia), and the diplococcus, or bacillus, of Fränkel. If, then, this organism is found in the buccal secretion of healthy individuals, how do so many escape attacks of pneumonia? In the light of recent studies made by Metschinkoff,† Baumgarten,‡ Osler § and others, it is more than probable that the phagocytes in a healthy individual, having healthy movements, are able to seize and assimilate the invading organism, and it is only when an individual is not well, when the phagocytes lose the power to battle against the specific organism of pneumonia from prolonged exposure to cold, that pneumonia sets in. The question of repeated attacks, or of immunity from second attacks, will not be considered here.

Personally, I have had a very limited experience in the experimental study of pneumonia. At the John Hopkins Bacteriological Laboratory I have isolated Fränkel's diplococcus from the blood and tissue of rabbits killed with Dr. Sternberg's saliva. I have also obtained the same organism from animals killed with prune-juice expectoration. The results of this work, just begun, will form the result of a later paper.

BALTIMORE, MD.

PROF. C. H. STOWELL, formerly one of the editors of THE MICROSCOPE, has resigned the Chair of Histology and Microscopy at the University of Michigan, and has taken up his residence in Washington, D. C., where he will enter into the practice of medicine.

THE Chair of Pathology and that of Histology in the Medical Department of the University of Michigan, have been consolidated, and Prof. Heneage Gibbes will occupy it.

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* Loc. citat.

† Virchow's Archiv., Vol. XCVII, etc.

‡ Zeitschrift f. Klin. Medicin, Bd. XV, H I and II.

§ New York Medical Record, April 13, 1889.

CONCERNING THE DIFFERENTIATION OF BLACK PIGMENT IN THE LIVER, SPLEEN AND KIDNEYS, FROM COAL-DUST DEPOSITS.*

FREDERICK GAERTNER,

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[PLATES IX, X AND XI.]

BOTH resist the various reagents, acids and alkalies; both lie for the most part within the smaller arteries. The difference exists on the one hand, in that the anthracotic pigment lies principally within the cells (Leucocytes), which is very unusual for micrococci; on the other hand—and this is the principal difference—in its relation to the different coloring fluids, especially anilin colors, and also to reflected and direct light. To distinguish the anthracotic pigment from fatty degenerated epithelial cells, fatty particles, etc., it is sufficient to note that the anthracotic pigment is not affected by the means that are used for recognizing fatty degenerations—such as osmic acid, sulphuric æther, etc. Finally, concentrated mineral acids serve to distinguish the anthracotic pigment from the putrid products of the epithelial cells, which, especially in the treatment with acetic acid, under the microscope, appear to be entirely black. But with mineral acids the epithelium cells immediately dissolve, while the pigment, as before stated, remains unchanged.

It appears from my (pathological) investigations, as the following protocols more minutely describe, that in these cases the intensity of the black pigmentation in the abdominal organs increases in exact proportion to the quantity of coal dust in the bronchial lymphatic glands, so that it increased according as the walls of the neighboring blood vessels of the slaty bronchial lymphatic glands were penetrated by the anthracotic substance.

Since the cases of my investigation in this respect are of some importance and support the theory that the black pigmentation of the abdominal organs is anthracotic, and not that of melanotic, I therefore annex the results of my investigations of ten cases:

* Continued from page 204.

Fig. 2.

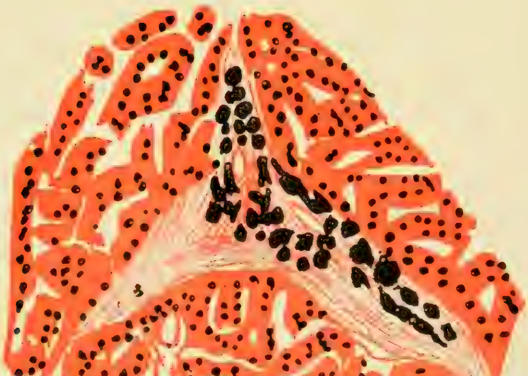

Fig. 3.

PLATE X.

CASE I: BY POST MORTEM EXAMINATION.—*Hemorrhagic pleuritis, thrombosis of the pulmonary artery in connection with the surrounding gangrene.*

The lungs are strongly affected with anthracotic pigmentation; the quantity of blood and air in them being diminished. The right lung is affected with senile atrophy and shows some vesicular emphysema; circumscribed slaty indurations are not apparent. On the contrary the lower lobe of the left lung is compressed to a great extent by a hemorrhagic exudation. The tracheal and bronchial lymphatic glands at the hilus (base of the lung) are very large and slaty, a few of them being of very solid consistence. Some of the same are adherent to the bronchi and blood vessels near which they lie. A shrunken, black gland lies close to the right principal bronchus, and has grown fast to it. An incision being made, a small opening was found, which led into the interior of the gland. A second enlarged, slaty, indurated, lymphatic gland lies close to the principal branch of the pulmonary artery, and is firmly adherent to it. The lumen of the artery is narrowed at that point where the black, solid gland lies, and the wall itself is considerably pigmented by anthracotic pigment. On opening the artery an autochthonal thrombus is found, which obviously came into existence through the contraction and the defect in the endothelium. The thrombus gave rise to the surrounding gangrene. A deposit of anthracotic pigment is found in the liver and spleen.

CASE II: P. M. EXAM.—*A well developed primary cancer of the gall bladder, with regional metastases in the liver and mesenteric lymphatic glands.*

Both lungs are strongly affected with anthracotic pigment; no particular indurations were present. The right lung shows croupous pneumonia, to which the patient succumbed. The left lung is, on the contrary, abundantly supplied with blood, but its capacity for air is greatly increased. The bronchial lymphatic glands at the base are very large, indurated and slaty. One of them especially is very black and shrunken; lies close to the principal branch of the vena-pulmonalis, and is adherent to it. The wall of the vein is completely penetrated at the junction by black (anthracotic) pigment, which chemically and microscopically corresponds with the inhaled coal-dust of the lungs, and the tracheal and bronchial lymphatic glands. An incision into the vein shows a small opening leading into the interior of the black lymphatic gland. In the liver and spleen is found a large deposit of pigment, especially of two kinds—a brown and a black one. Macroscopically

only a brown pigment can be seen, which, under the microscope, was found to be strongly ferrugious (consisting of chemically hydrated sesquioxide of iron.) Microscopically the black (anthracotic) pigment could be seen, which lies deposited along the smaller arteries (perivascular), and in the outer zone of the malpighian bodies. See Fig. 1–2, Plate IX. In the liver the black pigment was deposited not only within the glisson-capsule, but also in the tissue cells along the vena centralis. (Figs. 3 and 4, Plate X.) There was no anthracotic pigment in the kidneys; merely ferrugious (iron pigment).

CASE III.—*Embolism of the pulmonary arteries, and a simultaneous slaty and brown induration of the lungs.*

Anthracotic pigmentation of the lungs marked; the capacity of both lungs for blood is greater than normal, that for air less. The edges of both lungs are slaty; the lower lobes, on the contrary, are indurated and quite brown. Infarctions or softenings are not apparent. The bronchi are somewhat dilated, but there are no cavities. The tracheal and bronchial lymphatic glands at the base are enlarged, solid and slaty, a few of them being quite adherent to the neighboring bronchi and pulmonary arteries, the walls of which are more or less infiltrated with coal pigment. An incision into the right principal bronchus shows a radiated cicatrix, in whose center there is a small opening which communicates with the existing cavity in the interior of this black gland. A second lymphatic gland lying close to the left principal bronchus is calcified in toto with its capsule, and this mass has perforated the wall of the bronchus, and still clings rather closely to it. (Recklinghausen.)

The liver and the spleen show a condition of cyanotic atrophy, and a deposit of anthracotic pigment.

CASE IV.—*Exquisite slaty induration of both lungs.*

Anthracotic pigmentation is great; both lungs are highly marbled with slaty indurated cicatrices; the capacity for blood is rather increased, on the contrary that for air is diminished; the formation of cavities, or softening, are not present. The tracheal and bronchial lymphatic glands at the base are very large, indurated and slaty; one of the same is shrunken and entirely black, and lies close to the principal branch of the vena pulmonalis, and is adherent to it. At the point of junction the wall is considerably infiltrated with anthracotic pigment. An incision into the vena pulmonalis discloses at the place of the junction with shrunken black gland, a diverticulum, producing a traction-varix, evidently the product of chronic inflammation (*Lymphadenitis* and *Periaden-*

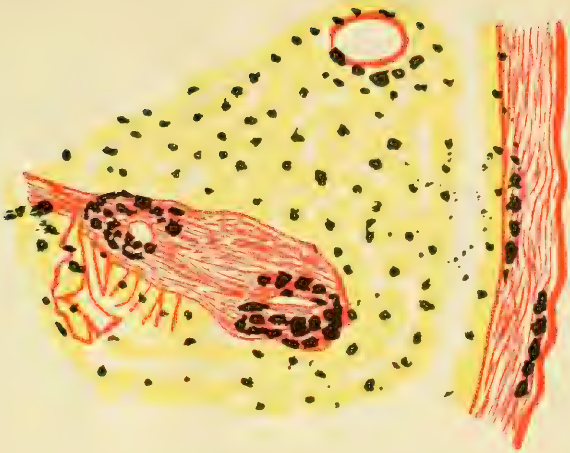

Fig. 4.

Fig. 5.

PLATE XI.

itis chronica), with simultaneous shrinking of the glands. In the liver and spleen there is a deposit of anthracotic pigment.

CASE V.—*Acute miliary tuberculosis of the lungs in a case of stone-cutter by trade.*

Anthracotic pigmentation of both lungs is only moderate, but highly marbled with *fine tubercles*, to which I have given the name of "*miliary stone-cutters' tubercle.*"—GAERTNER; slight, slaty induration, with marginal emphysema; no formation of cavities or infarctions. The bronchial and tracheal lymphatic glands at the base are enlarged, indurated and slaty; some are adherent to the bronchi and the surrounding vessels, the walls of which are more or less infiltrated with anthracotic pigment. On opening the bronchi and vessels, there was found an opening in the left principal bronchus. In the liver and spleen is found a deposit of black pigment.

CASE VI.—*Exquisite slaty induration of the lungs.*

The anthracotic pigmentation of the lungs is decidedly very great; the upper lobes of the right lung are almost devoid of air, and are considerably indurated with slaty cicatrices, in consequence of which several bronchial cavities (bronchiectasis) were found therein. At the same time, the quantity of blood in these lobes is diminished. On the contrary, the right lower lobe and the entire left lung have an increased capacity for blood, but are affected by vesicular emphysema. The bronchial lymphatic glands at the base are enlarged, indurated and slaty; a few of them are, to a great extent, adherent to the neighboring bronchil and pulmonary arteries, the walls of which are somewhat infiltrated with coal pigment. A larger, black, lymphatic gland is somewhat softer than the others and adherent to the right principal bronchus, the wall of which at the place of juncture is greatly infiltrated with anthracotic pigment. An incision into the bronchus shows a steel-like, slaty cicatrix, in the center of which was disclosed an opening. In the liver and spleen, there is a deposit of black pigment.

CASE VII.—*Œdema of the Lungs.*

Anthracotic pigmentation of both lungs is strong, but no special indurations ; blood capacity is increased, the capacity for air diminished. The bronchial and tracheal lymphatic glands at the base are very large and black but not especially indurated : a few of them have grown fast to the surrounding vessels, the walls of which are streaked with coal pigment. A larger black gland lies close to the right principal bronchus and is adherent to it. An incision disclosed a breach in the principal bronchus. The spleen is very large and

fibroid (chronic splenitis fibrosa): macroscropically the coal pigment is visible and is grouped principally along the arteries and in the periphery of the malpighian bodies, and lies in the lymphatic vessels of the capsule as a black, finely grained pigment. In the liver the pigment is macroscopically not visible, but only microscopically, and especially along the smaller perivascular arteries, in the interlobular tissue, in the cells of the tissue along the vena centralis; finally even in the larger perivascular lymphatic spaces and in the lymphatic vessels of the capsule. (See figures 3 and 4.)

In the kidneys no pigment could be found.

CASE VIII.—"*Stone-cutters' Lungs*" (*Chalicosis-Pulmonum.*)

Anthracotic pigmentation is strong, and the lungs are extensively dotted with knots, of almost stony hardness, (*stone-cutter tubercles.—Gaertner*), but shows no especial slaty induration: the blood capacity is increased and that of air diminished. Infarction or the formation of cavities is not present. Bronchial and tracheal lymphatic glands at the base are enlarged, indurated and slaty; several of them are adherent to the bronchia and vessels, the walls of which are more or less infiltrated with coal pigment. A shrunken black gland is adherent to the right principal bronchus. This principal bronchus being opened at the point of junction a radiated, slaty cicatrix is disclosed, the center of which is disintegrated so that with a probe one can easily penetrate into the interior of the gland. Black pigment was deposited in the liver and spleen.

CASE IX.—"*Slaty Induration of the Lungs.*"

Anthracotic pigmentation of the lungs is very marked; they appear almost entirely black. The right lung is greatly streaked with slaty indurated cicatrices and almost devoid of air, but rather well supplied with blood. Several bronchi-ectasic cavities are present. On the contrary the pigmentation of the left lung is less, as well as the induration, but it has some marginal emphysema. The bronchial and trachial lymphatic glands at the base are colosally enlarged; several of them are strongly indurated and black, and are adherent to the bronchia and the surrounding vessels, the walls of which are more or less streaked with anthracotic pigment. A larger black lymphatic gland is adherent to the principal branch of the vena pulmonalis, the wall of which is very strongly colored with coal pigment. An incision into the vena pulmonalis discloses an opening at the place of junction. In the liver and spleen there is a bulky deposit of pigment. In the latter it can even be diagnosticated macroscopically. In the kidneys there is a smaller mass of black pigment within a degenerated glomerulus; and which proved to be anthracotic pigment. See fig. No. 5.

CASE X.—"*Exquisite vesicular Emphysema of the Lungs.*"

Anthracotic pigmentation of the lungs is strong; they are not especially indurated, the blood capacity is rather normal. The bronchial and trachial lymphatic glands at the base are enlarged, indurated and slaty: some are adherent to the vessels and bronchia, close to to which they lie and the walls of which are streaked with black pigment. A larger black gland adheres firmly to the principal branch of the artery pulmonalis. An incision discloses a small opening which leads into the interior of this gland. In the liver and spleen there is a deposit of black anthracotic pigment.

To Prof. Dr. von Recklinghausen, who proposed and offered me the above problem for solution, and placed his pathological laboratory at my disposal, so that I was able to make a thorough and scientific investigation of the same, I here offer my most sincere and heartfelt thanks.

THE END.

STRUCTURE OF MUSCLE.

V. A. LATHAM, B. SC., F. R. M. S.

UNSTRIPED MUSCULAR FIBERS.

ISOLATION.—1. When the fibers are few and embedded in connective tissue, place a small piece of the tissue in 10 to 20 per cent. nitric acid (HNO_3) for a day; tease out in water.

2. When the fibers form the greater part of the tissue, place it in 33 per cent. alcohol one or two days, or in 2 per cent. ammonium bichromate one day, and then water one day. The fibers may be stained with eosin, hæmatoxylin, borax-carmine or picro-carmine, preferably after they have been teased out.

FIBRILLAR STRUCTURE OF THE FIBERS.—*a.** Take the fresh stomach of a frog, prepare a section at right angles to the surface and in direction of its length, with aid of a freezing microtome or Valentin's knife; mount it in 8 to 10 per cent. salt solution, and examine at once; or isolate the fibers by method (2) given above.

b. Take the epiploon, or other thin, vascular membrane, of a rabbit; place it for a day in 2 per cent. ammonium bichromate; stain with picro-carmine, and examine the optical transverse section of the muscular fibers coating the small arteries.†

c. Stretch out the mesentery of a newt,‡ and place it in 5 per

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* Englemann, Ouderz Physiol. Lab. Utrecht, Deel VI, Ast. 2, St. 4.

† Ranvier, Traité Technique et Histologie, p. 326.

‡ Klein, Quart. J. Micros. Sc., N. S. XVIII, p. 315, 1878.

cent. ammonium chromate for a day; remove to water for half an hour; stain with picro-carmine or hæmatoxylin, and mount in glycerin. Cells which divide at their ends may be seen in the (*e. g.*) urinary bladder of a frog.

OBLIQUELY STRIATED MUSCLE.—Cut through both attachments of the posterior adductor muscles of an anodon; place the posterior yellowish part in 33 per cent. alcohol for a day. A small strip should also be examined fresh. The angle between the crossing fibrillæ is greater in the yellow part of this muscle than in the white dorsal part. A few fibers should be torn off and examined straightway in the blood of the animal, or in .75 per cent. salt solution. To isolate the fibers and to bring out more distinctly the fibrillæ, the muscle should be placed in 30 per cent. alcohol or 1 per cent. potassium bichromate for one or two days, and a small piece teased out in the isolating fluid. To obtain the fibers in the extended state, a wedge should be forced between the shells, and the whole animal then placed in the reagent. To obtain the fibers contracted, it is sufficient to cut away the muscle from its attachments. Similar muscular tissue is present in many other invertebrates. It occurs, for instance, in the skin muscles of *Lumbricus terrestris*, and in the foot muscle of *Helix pomatia*.

STRIATED MUSCULAR FIBERS.

LIVING FIBERS.—These muscles may be pinned out whole over a ring of cork. The mylohyoid of the frog and the subcutaneous muscles of the face and neck of the rabbit may be so treated. With thick muscles a few fibres should be torn out and mounted in aqueous humor or fresh serum. The fibers of insects are best mounted in the blood of the animal. According to Nasse, a 1—1.5 per cent. salt solution is better than a 6 per cent. for certain muscular fibers (*e. g.*, flies). In some fibers contraction waves may be seen; as the fibers die, one part of the fiber may be seen to be contracted, and the contraction to spread from this spot towards the end of the fibers. The behaviour of the various bands should then be carefully noted.

MUSCLE TREATED WITH REAGENTS.—To observe the various bands the muscle should be stretched before being placed in the reagent. This may be done conveniently by cutting out the parts to which the muscle is attached, and pinning out the attachments of the muscle over a ring of cork. The most generally useful reagents are absolute alcohol, osmic acid, 0.5 per cent. for about five minutes, then alcohol; a concentrated aqueous solution of salicylic acid (this, like

alcohol, coagulates the proteids of the muscles, but it also swells up the connective tissue), 33 per cent. alcohol.*

With *insects*, *e. g.*, cockroach and dytiscus, the reagent may be injected into the body cavity, or the insect, *e. g.*, a caterpiller, may be placed whole into the reagent. In both of these cases, some fibers may be usually found with fixed local contraction waves. A convenient way of obtaining fixed contraction waves is in many cases by tearing out a leg and placing the protruding fibers into osmic acid 0.5 per cent., or into absolute alcohol. Good specimens may be thus obtained from the crawfish. In such specimens, note carefully the appearances of the bands as the microscope is gradually lowered from the highest to the lowest point at which the bands are visible. Hardened fibers may be stained in hæmatoxylin or eosin.

MUSCLE FIBERS IN POLARIZED LIGHT.

To observe the singly and doubly refracting parts of muscle fibers, take an animal, such as hydrophilus, in which the bands are broad, stretch out one of its muscles and place it in 50 per cent. alcohol for a day, then gradually increase the strength of the alcohol until it is absolute. Tease out a few fibers on a slide, clear with clove oil, and mount in C. balsam. Only those fibers in which the planes of the discs are at right angles to the plane of the glass should be observed.

If fresh fibers are treated with dilute acids, alkalis or ammonium chloride (as above), and then hardened, the doubly refracting substance will be found to have largely disappeared. The fibers do not lose their doubly refracting power on boiling, provided they are kept extended. (*Nasse.*)

VARIETIES IN THE FORM OF MUSCULAR FIBERS.

Take the heart of a sheep, as fresh as possible, and carefully examine the endocardium of the ventricle, certain transparent, jelly-like lines and spaces, and carefully remove the isolated piece of endocardium, removing as far as possible the subjacent cardiac muscle fibers. Purkinjes' cells will be found in the connective tissue of the endocardium. The cells may be isolated by 33 per cent. alcohol, and stained with picro-carmine.

Branched striated muscle fibers may be seen in the tongue of the frog.

Fresh muscle fibers, when warmed with dilute acids or dilute alkalis, are partially dissolved, the dim band being chiefly affected. The solution of the substances of the dim band is still more marked

* When a muscle cannot conveniently be extended, a concentrated aqueous solution of boracic acid may be used. This does not coagulate the proteids of muscle, and causes little or no shrinking. (*Nasse.*)

when the fibers are warmed with 5 to 10 per cent. solution of ammonium chloride. It is best to mount a few fibers in a shallow glass cell, to cement the edges of the cover-slips, and observe the fibers from time to time. A small piece of muscle may also be placed in a watch-glass or a small beaker, and warmed with the reagent, and at intervals a few fibers taken and fixed with osmic acid, salicylic acid or alcohol.

I find a good way is to place small pieces of the fresh muscle of frog or lizard in formic acid 25 per cent., until transparent; then into gold chloride, 1 per cent., 15 to 20 minutes; formic acid, 25 per cent. for 24 hours in the dark; formic acid, 50 per cent., 24 hours in the dark; 20 per cent. formic acid glycerin, two to three weeks, until sufficiently lightened in color. The connective tissue is now macerated sufficiently to let the muscle fibers easily separate. Mount in acidulated glycerin (1 per cent. formic acid). Muscles of hydrophilus may remain three hours in $\frac{1}{2}$ per cent. chloride of gold solution. This method may be used to study the nerves of small arteries and veins.

For fresh, smooth muscle (bladder of salamandra), a bladder is hardened in bichromate of potash, 1 per cent. or more. Remove the epithelium by penciling. Stain the tissues with hæmatoxylin, eosin or anilin, and examine in water (preferable to glycerin).

To make the iris denser and more easy to split so as to show musclus dilatator papillæ, proceed as follows: Chromic acid, 0.01 per cent.; chloride of gold, 0.1 per cent.; Palladium chloride. The iris may be stained by putting for some hours into strong acetic acid, and then with an acid mixture of carmine and glycerin.

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UNIVERSITY OF MICHIGAN, ANN ARBOR.

PROCEEDINGS OF SOCIETIES.

THE SAN FRANCISCO MICROSCOPICAL SOCIETY.

A REGULAR meeting of this society was held June 26, 1889, with a large attendance of members. President Payzant occupied the chair. Frank L. James, M. D., and Prof. H. M. Whelpley, of St. Louis, were present as visitors; also, M. R. Roberts, of this city, and L. M. King, of Santa Rosa.

The President announced, with regret, the death of F. L. Howard, for many years a member of the society.

Dr. James is well known to microscopists by his able contributions to this branch of science. He gave an interesting account of a phenomenal class of crystals produced from salicine by the ex-

treme cold method as discovered by him several years ago, and exhibited a series of slides with the polariscope, which were pronounced by all to be the most beautiful crystallizations ever seen. The process depends on bringing a saturated solution of salicine made with distilled water in contact with cold below the freezing point and Dr. James' explanation is that the rapid congelation of the water interferes with the usual arrangement of the crystals, producing the wonderful series before alluded to, which are entirely unlike any forms resulting from crystallization at the ordinary temperature. The proper manner of making white-zinc cement and permanent oxydized enamels for ringing slides formed a portion of his interesting contribution to the meeting.

H. M. Whelpley, of the St. Louis Microscopical Club, also addressed the society on the subject of the microscope in its relation to pharmacy, pointing out the rapid progress being made in the detection of adulterations and the interest manifested generally among pharmaceutists in studying the character and acquiring a correct knowledge of the crude constituents of the *materia medica.*

Pond life was illustrated by numerous specimens of *Ceratium longicornis*, and the beautiful little organism, *Artemia salina*, or brine shrimp. Entomology was represented by prepared slides of the larva of several varieties of the *Papilio* family.

Professor Hanks presented for examination a venerable edition of a work on Pharmaceutics published by Robert Lowell in 1661.

Mr. Riedy donated a copy of Trembley's work on fresh-water Polypes, an exceedingly rare and valuable book published in 1744.

JULY 10, 1889.—Vice-President Breckenfeld presided, and, after calling the meeting to order, spoke very feelingly of the death of F. L. Howard, one of the old-time members, and offered the following resolutions, which were unanimously adopted :

WHEREAS, our late esteemed friend and fellow-member, F. L. Howard, has been called from earth by the final summons, and we who have been associated with him in the San Francisco Microscopical Society are desirous of placing on record some fitting expression of the high regard in which we held him and of the sorrow we feel at his loss ; be it

Resolved, that in the death of Mr. Howard this society is called upon to mourn the loss of one who, for many years, has been untiring in his devotion to its work and his interest in its welfare, and who endeared himself to its members by his quiet enthusiasm in microscopical research and by his genial and kindly disposition.

Resolved, that these resolutions be spread upon the minutes of the society and a copy conveyed to his bereaved consort, with the assurance of our warmest sympathy and most sincere condolence.

The society then adjourned.

C. P. BATES, *Rec. Sec.*

EDITORIAL.

THE remark is often heard, "I own a microscope, but I never use it, for I do not quite understand its manipulation, and the proper preparation of specimens is beyond me." Reader, do you own a microscope, and if you do, what use are you making of it? When you bought the instrument years ago, perhaps, you determined that you would learn its use and apply it to the practical parts of every day life. Have you done so? Has the microscope helped you to unravel any of the knotty questions which assail you daily in your professional work? Or have you consigned the instrument to a place under a glass shade on the mantel, or the dispensing counter, or somewhere in the parlor or library? If you are a physician, is not this microscope on the stand—which you never use, but which is so placed, intentionally, that your patients will think that you employ it in diagnosing your cases, on the order of fake? And would you not condemn a like petty deceit in a fellow-practitioner? What druggist is there who uses the microscope but is well paid for the time expended by the detection of frauds in his drug stock, the determining of crystalline deposits, and the examination of sediments? To the dentist, also, the microscope has become an instrument of much importance, and the pages of dental literature are filled with enthusiastic reports of the results obtained from microscopical examinations. In fact, there is no profession, no trade, in which the microscope is not of the greatest *practical* use.

For those who would like to know something of the practical portions of microscopy, nothing is of greater value and importance to them than attendance on the annual meetings of the American Society of Microscopists. At these gatherings the visitor not only obtains great help from the papers read and the discussions which follow, but coming in touch with the other members present, he, or she, receives a stimulus to renewed efforts not otherwise obtainable. There are to-day thousands of men and women in this country who own microscopes, and who need just this sort of help. The expense of attending the convention is only nominal, compared with the benefits to be derived.

The twelfth annual meeting of the Society is to be held at Buffalo, N. Y., a point easy of access from all parts of the country, August 20th to 23d. A large number of valuable papers have already been pledged. The working session is an assured success, and will combine certain new and original features, and at the soiree it is expected that more than three hundred objects will be shown. This latter exhibition will be given Thursday evening, August 22nd, at the spacious library rooms, where the collections of the Art, Historical and Natural Science Societies will also be thrown open to the public.

Not only have the local committees shown themselves exceedingly active and in full sympathy and harmony with the A. S. M.'s work and aim in their arrangements for the scientific portion of the meeting, but they have also sought to combine the social with the intellectual, and have announced an afternoon upon the beautiful Niagara River, or a visit to the Falls, an hour's ride by train from Buffalo. This diversion alone is worth a journey, and should prove attractive to a large number who have never as yet gazed upon this wonder of nature. Taken all in all, the coming meeting of the American Society of Microscopists bids fair to be the most successful ever yet held.

It is to be hoped that the members will avail themselves of the rare treat offered, and will make every effort to be present during the four days' session.

For further information, the Chairmen of the various committees may be addressed :

George E. Fell, M. D., F. R. M. S., Chairman Exhibition Committee, 72 Niagara St.

Stephen Y. Howell, M. D., Chairman Working Session, 164 Franklin St.

Louis A. Bull, M. D., Chairman Hotel Committee, 160 Franklin St., Buffalo, N. Y.

All abstracts and titles of papers should be reported at once to Prof. T. J. Burrill, Champaign, Ill.

ACKNOWLEDGMENTS.—From Mr. F. W. Weir, Norwich, Conn., we have received two excellent photo-micrographs of type plates of diatoms mounted by Kimböck, and belonging to Miss M. A. Booth. There are some 250 diatoms in each plate, and the details are remarkably well brought out. The apparatus used by Mr. Weir was home-made ; the illumination, a kerosene duplex burner.

ZOOLOGY.*

COCCIDIA IN THE RENAL EPITHELIUM OF THE MOUSE.†—In examining some mice which had died within two or three days following inoculation with hog cholera bacilli, Theobald Smith discovered the somewhat rare parasitic protozoon, coccidia. The kidneys presented an abnormally pale, yellow appearance, and without doubt the degenerated condition of these organs had greatly reduced the vitality of the mice and their resistance, which on an average continues from seven to ten days after inoculation, to the invasion of the pathogenic bacteria. Small portions of the kidney cortex, teased in salt solution, revealed large numbers of nearly round bodies, having a long diameter of about 16.2 μ, and a short diameter of 12.6 μ. Each body consisted of a cyst, the interior of which was densely packed with crescent-shaped bodies, evidently representing the final or spore state in the life of the micro parasite. The cyst wall was represented optically by a narrow sharply defined dark line, and when crushed under the cover-glass in order to force out the contents, its shrunken remains appeared transparent and colorless. The cysts contained as nearly as could be ascertained, about twenty crescent-shaped bodies, filling out the entire cavity. In form, these crescent-shaped, or more properly falciform bodies, might be compared to bananas, having a little greater curvature than the average fruit of that name. Their two extremities were blunt and rounded. Their length was 7 μ. Their greatest diameter 1.8 μ. The substance composing them appeared homogeneous in the fresh condition. When packed away in the cyst, their long axes were in general parallel, so that their extremities came to lie at two opposite poles. These pore cysts were in part isolated, in part united into groups from several to twelve each, and surrounded by a very delicate line, which, in some cases, could be demonstrated as the attenuated periphery of the cell body. These groups, in other words, were contained in large vacuoles formed in the protoplasm of the epithelial cells between the free border of the cells and their nucleus. None of the cells observed in the teased portions contained more than one vacuole. The wall of the vacuole either adhered snugly to the group of cysts, thus forming a rather irregular elongated sac, or the vacuole was spherical and but partly filled up by these cysts.

*Under this heading will be included all Abstracts relating to the Embryology, Histology, etc., of Vertebrates and Invertebrates.

†Journal Comparative Medical and Surgical, July, 1889 p. 211.

ANATOMY OF CLITELLIO.*—Beddard, having investigated the oligochetous worm clitellio, finds that the previous descriptions by Claparède are, to an extent, both incomplete and incorrect. The testes in this genus, differing in no essential from those of tubifex, lie in the tenth segment, into which open the funnels of the vasa deferentia. Each organ is long and narrow and somewhat swollen at the base of attachment to the body wall. In the generative system of a young example, of *C. Arenarius*, the cells of the vasa deferentia are not ciliated. The v. d. pass in a slightly sinuous course to the atrium, which opens externally, not far from the posterior border of the eleventh segment. The atrium in the undeveloped condition is lined by a simple non-glandular columnar epithelium. It is invested externally with a thin coat of muscles, outside of which is a tolerably thick layer of glandular peritoneal cells. The spermathecæ are simple pyriform vesicles, lying in the tenth segment. Upon the anterior face of the septum, which separates the eleventh from the twelfth segment, and corresponding exactly in position to the funnel of the vasa deferentia, is a disc-shaped layer of columnar cells, which is evidently the oviduct, the cells of which, at this stage, are like the cells of the vasa deferentia funnels, not ciliated. In the sexually mature animal, the oviduct funnels are extremely conspicuous cell-shaped organs with abundant cilia.

The ovaries are situated in the eleventh segment on the anterior mesentery, close to where this is perforated by the vasa deferentia. The sexual organs in *C. Ater.* and *C. Arenarius* differ somewhat. In *C. Ater.* there is a distinct and large prostate gland, which opens into the distal extremity of the glandular part of the atrium. In *C. Arenarius* these glands seem to be absent. The glandular part of the atrium in the latter is relatively larger than that portion of the former. The glandular portion of the atrium, although exhibiting the same structure, is relatively smaller than that of *C. Arenarius*, and is entirely contained within the eleventh segment, and is not curved upon itself. The vas deferens is very long and much coiled. It opens into a rounded chamber at the extremity of the atrium, the cells of which are different from those of the atrium and more like those of the vas deferens. In *C. Arenarius* the vas deferens is much shorter and wider, while the atrium is much larger ; on one side of the body, in the single mature example of this species investigated by sections, the atrium was bent upon itself and entirely contained in the eleventh segment. On the other side of the body the atrium extended back beyond this segment. The

* Proc. Zool. Soc. London, Nov. and Dec., 1888, p. 485.

funnels of the vasa deferentia in both species are cup-shaped and furnished with abundant long cilia. The mature ova are of very large size, half the diameter of the body, and loaded with yolk spherules. In *C. Arenarius* they were found back as far as the 13–15 segments; in the first and last of these segments was a single ovum; in the middle one, two. The ova were not freely floating in the body cavity, but were inclosed in distinct sacs, furnished with blood vessels. These sacs were perfectly independent of each other. There was no communication that could be traced between the ovisacs of adjacent segments. In *C. Ater.* there appeared to be a similar arrangement. The spermathecæ of the sexually mature worm offer a valuable differential character; they are more complicated in *C. Arenarius.* The spermathecæ of this species is divided into two parts by a median constriction. In that part which communicates with the exterior only are found the spermatophores. The distal pouch in Beddard's specimen contained a liquid deeply stained by the coloring reagent. Its walls, moreover, were lined by epithelium of a different character to that found in the proximal part of the spermathecæ. The spermathecæ extends beyond the tenth segment; in the sexually mature individual it reaches back as far as the thirteenth segment, where it traverses the boundary line between the twelfth and thirteenth segments; the next septum, between the twelfth and thirteenth, comes in close relation with the septum dividing the segments 11, 12; at this point the septa almost fuse, and the spermathecæ passes directly from segment eleven into segment thirteen. Where it traverses the two mesenteries, there is another constriction, but the epithelium does not change in character.

MICROSCOPY.*

SCHULTZ' METHOD FOR STAINING AND DETECTING GONOCOCCI.†—Prepare the cover-glasses in the ordinary manner and immerse them from five to ten minutes in a saturated solution of methyl blue in a five per cent. solution of carbolic acid. Wash in distilled water and immerse for a very few seconds in a very dilute acetic acid, one minim of the acid to the drachm of water. Washing in distilled water completes the process, though, if desired, a dilute solution of saffranin may be employed as a complementary stain. Otherwise the gonococci will appear stained blue on a quite decolorized back-ground.

*Under this heading will be included descriptions of New Instruments, Microscopical Manipulations, Stains and Re-agents, Photomicrography, etc.

†St. Louis Medical and Surgical Journal, July, 1889, p. 45. From Muenchener Med. Wochenschrift.

ISOLATION, STAINING AND MOUNTING OF CORNEAL CELLS.*—The method of His, modified by Ranvier, gives excellent results. Place a small piece of the fresh unmanipulated cornea in a mixture consisting of sulphuric acid and distilled water in equal parts, and keep it there for a few moments or until the basal substance softens. Pour off the acid mixture and replace it with distilled water. Lift the bit of cornea on to a slide and put on a cover-glass, pressing the latter to place with a light to and fro motion. This suffices to loosen and separate a vast number of individual cells, or of lamellæ of them, which can be examined in situ. A minute drop of a solution of fuchsin, sulphate of rosanilin, or anilin-red, may be added, and it imparts a permanent stain to the cells which brings out all the details beautifully. For permanent mounting, glycerin should be used. In these preparations the stellate cells, anostomosed by prolongations of the points, are finely shown, though the nuclei are not seen. This method also shows the image crests, *cretes d' empreinte*, now well-known.

ELECTRO-GRAPHOSCOPE.†—At the recent conversatione of the Royal Society at Burlington House, given by Prof. G. G. Stokes, M. A., President, a new adjunct to the optic lantern, invented by Mr. Eric S. Bruce, was exhibited. It consisted of a white lath about an inch wide and eighteen inches long, which was made to rotate windmill-fashion by an electro-magnetic motor. A picture then thrown on the rotating lath by the magic lantern was visible in its entirety, on the principle of the retention of vision. The background some distance behind the lath was also visible, hence the picture cast by the lantern, which was one representing a statue, seemed to stand out in mid air.

PATHOLOGY.‡

THE MICRO-ORGANISM OF PERTUSSIS (WHOOPING COUGH).§—In 1870 Lezerich discovered micro-organisms in the sputum of pertussis, which on further investigation turned out to be a harmless Saprophyte. Tschamer found a fungus, *Capnodium citri*, but this is also found in oranges and apples. Deichler discovered an organism belonging to the protozoa, evidently not the pathogenic microbe of the disease. Herke describes small round cells, clearly only lymph

*St. Louis Medical and Surgical Journal, July, 1889, p. 44.

† Popular Science News, July, 1889 ; p. 99.

‡Under this heading will be included all Abstracts relating to the Histology of Diseased Tissues, both Animal and Vegetable.

§Medical News, June 2, 1889, p. 598.

corpuscles. Poulet's *monas termo bacterium termo*, have nothing to do with pertussis, the Frenchman to the contrary notwithstanding. Burger's rod-shaped bacillus were not proven by culture and inoculation experiment to be what the discoverer claimed. The most recent pathological announcement is by Afanasieff, who discovered a microbe, somewhat like Friedländer's pneumonia bacillus. It is, however, shorter and thiner than the latter, and in gelatin does not form nail-shaped cultures, those which are produced having no hemispherical head. In potato culture it is also quite different. Afanasieff's bacillus exhibits a remarkable degree of vitality; taken from dried cultures which have been kept for months, and appearing under the microscope to be more or less destroyed, it still is capable of producing fresh cultures.

It appears in short rods ranging in length from 0.6μ to 2.2μ, and is sometimes single, sometimes in twos, sometimes in clusters, and even in short chains running in the direction of the mucus.

MISCELLANEOUS.

HOME-MADE APPARATUS.—The time required to get together an old-fashioned apparatus makes it utterly impossible for a teacher in a public school to use it. Again, the time required for the manipulation of it in the class, causes the pupil's mind to wander to other thoughts than that of the principle which is to be illustrated. Add to this the fact that home-made apparatus is so suggestive of scientific principles that, while the student is making it, his mind is constantly learning something new, and we have ground for the statement that *home-made apparatus economizes time sufficiently to make it practicable to teach science experimentally in the public schools.*

Perhaps the chief argument in favor of home-made apparatus is what might be called the manual-training argument—*i. e.*, the argument of its educational value to the student who constructs it. It is always noticeable that the student who makes his own apparatus is not only liable to get a better comprehension of the principles which it illustrates, but his mind is thereby stimulated to inquire into many kindred principles.—*Prof. John F. Woodhull, in the Popular Science Monthly for August.*

"TERCENTENARY" OF THE MICROSCOPE.*—The three hundredth anniversary of the invention of the microscope will be celebrated by

* The British Medical Journal.

the Executive Committee of the International Exhibition of Geographical, Commercial and Industrial Botany at Antwerp in 1890. A retrospective exhibition will be got together from all available quarters, illustrating the history of the microscope, as well as an exhibition of the modern instruments of existing workers. A variety of conferences relating to technical and scientific questions connected with the microscope will be arranged. Already great interest is being expressed in the proposed exhibition.

NEWS AND NOTES.

DR. PAUL B. BARRINGER, of Davidson College, N. C., has been elected to the chair of Physiology and Surgery at the University of Virginia. Dr. Ballinger is a well-known microscopist, and in his new field will undoubtedly be able to accomplish much in this department of science.

DR. FRANK L. JAMES, in *St. Louis Medical and Surgical Journal*, says: I believe that the Elder Spencer, who soon followed his friend Tolles to the silent land, was as good as Tolles. I believe further that his son Herbert Spencer, is second to no living optician. That Gundlach has produced and is producing objectives, the excellence of which cannot be duplicated in Europe to-day, and that for certain grades of objectives, those of Bausch and Lomb are absolutely incomparable. American opticians have absolutely nothing to fear in competitive contests, so far as excellence of work goes, with any in the world. I have no patience with Americans who are sending abroad for microscopes and objectives. They can get better at home for the same expenditure of money.

DR. GAMALEIA is said to have offered to resume his former position as director of the Bacteriological Station at Odessa. The authorities have declined.

FROM what has been accomplished recently in microscopy in revealing the hidden forces of nature, through all the imperceptible gradations of birth, development, life; and on the other hand the processes of retrograde metamorphosis, destruction, death; the dental profession preëminently has reason to congratulate itself upon the possession of so many skilled workers in this special field of study. The importance of the microscope in dentistry has never been felt so strongly as at present. The perfection of its machinery which enables a microscopist to confirm the truths of his patient research to a whole room-full of people at once, is a wonderful step in advance.—*President's address, Michigan Dental Association, 1889.*

LONGEVITY OF MICROBES.—Micro-biologists have not yet been able to decide the important question as to how long micro-organisms retain their vitality. Their wonderful proclivity to proliferation leads us to suppose that the life of one of these minute bodies is not longer than a few days or a few weeks at most. But clinical facts do not support this supposition. It is well known that the poisons of scarlet fever, measles, diphtheria and other diseases may remain active for many months in rooms that have been occupied by patients suffering from these diseases.—*Weekly Medical Review, May 18, 1889, p. 543.*

THE heirs of the late M. Chevreul have presented his library of 10,000 volumes to the Paris Museum of Natural History.

I COULD fill a volume with the adulterations which I have found within a few years past in articles of food and drink in common use, by microscopical and chemical analysis.—*Piper.*

I WAS examining the circulation of a frog's lung by means of the Holmgren apparatus. I happened to so focus my lens that all the outlines of the capillaries and blood corpuscles disappeared, leaving visible only the spaces between the epithelial cells. Nevertheless there remained a vision of the streaming movement of the invisible blood through the ramified spaces. The stream was so rapid, so energetic, so ceaseless, it seemed as if it were pure motion or force divorced from the accidents of matter. The microscopic shred of tissue from the insignificant animal seemed for the moment to give a glimpse of a mighty vision of endless life, streaming with infinite energy into the minutest particles of an infinite universe. The impression was indescribably powerful.—*Mary Putnam Jacoby.*

D. PETRI, who was formerly keeper of the Hygienic Museum in Berlin, has been appointed chief of the Bacteriological Department in the Imperial office of health.

THE microscope extends the realm of Pathological anatomy to the limits of the invisible world.—*Huxley.*

WHATEVER, then, makes it possible, safely, easily, and without pain, to remove (morbid growth) for microscopical examination a sufficiently extensive piece of the mass to show its deep as well as superficial structures, is of much practical value.—*R. S. Conner.*

THE typhon bacillus will live and increase in decomposing fecal masses for fully four months. They gradually decrease at a temperature of 50° F., but increase at 63° F. Cholera bacillus, on the other hand, is easily destroyed, and will only live in fecal masses four days at longest.

AN oxalic-producing ferment has been discovered by W. Zopf. He calls it saccharomyces hansenii.

PROF. L. H. PAMMEL, who has been investigating the root-rot of cotton, a cotton blight, concludes that the disease is due to a fungus mycelium.

THE Croonian Lecture for 1887, which was to have been delivered by M. Pasteur, was read by M. Roux, on account of the former's illness. The subject was "Preventive Inoculation."

THE Astley-Cooper prize, amounting to $1,500, will be awarded in 1892. The question proposed is, "The Influence of Micro-organisms upon inflammation." The papers must be written in English, or accompanied by an English translation, and should be addressed before January 1, 1892, to Guy's Hospital, London. The prize will not be awarded to two or three working conjointly.

THE AMERICAN GEOLOGIST, now in its third year of publication, is a worthy representative of that department of natural science on this continent. Besides the strictly technical articles, it contains much of interest and value to the general reader. Among its editors and contributors are the ablest geologists in this country. It is published in Minneapolis, Minn.

APROPOS of the interesting communication of Dr. F. O. Jacobs in the June number of *The Microscope*, the attention of dental microscopists and others who are interested in the subject is called to an illustrated article by Dr. R. R. Andrews, of Cambridge, Mass., in the April number of *The Dental Review*.

BIONDI has isolated from the saliva five varieties of micro-organisms which have distinct morphological and biological characteristics, and differ in the symptoms they produce in inoculated animals.

THE ptomaine produced by the bacillus of mice septicæmia is called methylguanidine. One-thirty-second of a grain is sufficient to kill a rabbit.

BOOK REVIEWS.

PROCEEDINGS AND ADDRESSES AT THE SANITARY CONVENTION HELD AT HASTINGS, MICH., DEC. 3 AND 4, 1888.

PROPER FORMS OF ADDRESS. Reprinted from Alden's Manifold Cyclopedia. J. B. Alden, publisher, New York.

NINETEENTH ANNUAL REPORT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, 1888. Toronto: Warwick & Sons.

This report contains a number of valuable contributions on insects, and several sketches of noted entomologists.

THE ENGLISH SPARROW IN NORTH AMERICA; ESPECIALLY IN ITS RELATION TO AGRICULTURE. Prepared under the direction of Dr. C. Hart Merriam, Ornithologist, by Walter B. Barrows, Assistant Ornithologist.

This rather bulky pamphlet of 405 pages forms bulletin No. 1 of the division of Economic Ornithology and Mammalogy, U. S. Department of Agriculture. It is a history of the importation of the sparrow, together with a record of its habits, increase, checks, etc. The English-sparrow question, as Dr. Merriam says, has grown to be a serious problem in economic science, and the government has done well in thus collecting the evidence against this pest, with suggestions for its extermination.

PROCEEDINGS OF THE CALIFORNIA ACADEMY OF SCIENCES, SECOND SERIES. VOL. I; PARTS 1 AND 2.

These proceedings contain many valuable papers, largely on the flora and fauna of California.

PREMIUM LIST DETROIT INTERNATIONAL FAIR AND EXPOSITION.

THE CLIMATE OF SOUTHERN TEXAS AND ITS ADVANTAGES AS A HEALTH RESORT. By M. K. Taylor, M. D., Major and Surgeon U. S. Army, retired. Reprint.

THE RADICAL CURE OF HERNIA. By Thomas W. Kay, M. D. Reprint.

STUDIES ON THE ETIOLOGY OF THE PNEUMONIA COMPLICATING DIPHTHERIA IN CHILDREN. By T. Mitchell Prudden, M. D., and William P. Northrup. Reprint.

SULLA RIPRODUXIONE DEGLI ORGANI GUSTATORI. LUIGI GRIFFINI. Abstracted by F. Tuckerman. Reprint.

ON VOLVOX GLOBATOR AS THE CAUSE OF THE FISHY TASTE AND ODOR OF HEMLOCK LAKE WATER IN 1888. By M. L. Mallory, Geo. W. Rafter, J. Edw. Line. Illustrated by two photogravures from photo-micrographs by Line and Rafter.

PRELIMINARY LIST OF THE FLOWERING AND FERN PLANTS OF LORAIN COUNTY, OHIO. Compiled by Albert A. Wright, Professor of Geology and Natural History in Oberlin College.

THE TREATMENT OF THE MORPHIA DISEASE. By Dr. Albrecht Erlenmeyer. Physicians' Leisure Library, Detroit; Geo. S. Davis, publisher. Pp. 113; price, 25 and 50 cents.

This little book is a chapter taken from the well-known work of Erlenmeyer on the morphine habit, and contains an epitome of the three methods of treatment in vogue—the gradual, the sudden and the rapid modes. The author's own preference is for the last-named method, but we hardly think that the majority of those who have had experience in the treatment of this habit will agree with him on this point. It is rarely the case that a patient is so low physically that the sudden method, the immediate withdrawal of the drug, will not prove the most successful plan to pursue. The first twenty-four hours will usually break the back of the habit, and although the *delirium maniacale* may be severe, the habit is pretty effectually

broken up. The book before us will well repay a careful reading, and every physician should be familiar with the subject of which it treats.

ENGLISH, PAST AND PRESENT. By Richard Chenevix Trench, D. D., Archbishop of Dublin. The Humboldt Pub. Co., 28 Lafayette Place, New York. Two parts ; pp. 162. Price, 15 and 30 cents.

Archbishop Trench's book has been before the public too long as the standard on English language to need an introduction. There are many, however, who have not yet read this delightful history of our language, and many more who will be glad to re-read what has proved so instructive and entertaining in the past. The book as published by the Humboldt Publishing Co., in two parts, is well printed on good paper, and in their well-known convenient form it is just the book for quiet summer afternoons. Nos. 108 and 109 of the Humboldt library series.

A MANUAL OF THE VERTEBRATE ANIMALS OF THE NORTHERN UNITED STATES, ETC., by David Starr Jordan, President of the University of Indiana. Chicago, 1888: A. C. McClurg & Co. Pp. 375.

Dr. Jordan's Manual is already so well known to teachers and students of natural science, that it is only necessary for us to call attention to the fact that the work has recently appeared in its fifth edition, entirely rewritten and much enlarged. The latest corrections and additions render the book as perfect as it is possible for such to be, and no teacher who is interested in his work will fail to add the new edition to his library. As a clear, concise and forcible writer, Dr. Jordan has few equals ; and as an analytical key to vertebrate fauna, his Manual still remains unrivaled.

CORRESPONDENCE AND QUERIES.

H. D. R., COVINGTON, KY.—The best work on urinary sediments is the "Atlas of Physiological and Pathological Sediments in the Urine," by Ultzmann & Hoffmann. It contains numerous beautiful plates. Although it is designed to go with their work on urinalysis, any other good text-book will answer.

Fränkel & Pfeiffer's Atlas of Bacteriology has not yet been translated into English or re-published in this country. It will appear in 15 parts ; parts I and II, including the introduction and ten photo-micrographic plates, are now ready for distribution. We can furnish the parts as they appear for $1.50. It is needless to say that this work will be the finest of the kind ever published.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS *who have microscopical apparatus' material or books which they wish to exchange, and such wants will be* INSERTED FREE OF CHARGE. *The number of insertions given will depend upon the number of exchanges received each month. Subscribers will please notify us when articles have been exchanged or sold. Dealers are referred to our advertising department.*

FOR SALE CHEAP—A Beck's Economic Binocular, in perfect condition, complete, with four eye-pieces and one-sixth inch objective, for $70. Address
L. M. KING, Santa Rosa, Cal.

FOR SALE CHEAP—A Bausch & Lomb Polariscope in first-class condition. Address
W. J., 32 West Noble St., Columbus, Ohio.

TO EXCHANGE—Vols. V and VI of THE MICROSCOPE, which I will sell for $2.50 and take cover-glasses as pay—½ and ¾, and some square.
A. MILLER, North Manchester, Ind.

FOR EXCHANGE—A Hailes "Poly-Microtome" (an automatic microtome for freezing or paraffin-embedding), in exchange for a Kodak camera, or other good "detective."
C. E. HANAMAN, Box 27, Troy, N. Y.

WANTED—A copy of each of the following numbers of *The Microscopical Bulletin*, Vol. I, No. 5, August, 1884, and Vol. II, No. 1, February, 1885. For either of them, I will send a first-class microscopic slide, or for both I will send three slides.
M. S. WIARD, New Britain, Conn.

FOR SALE CHEAP—A Bausch & Lomb Universal Microscope complete, with objectives and accessories, perfectly new. Address
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WANTED—Vols. I to VI of THE MICROSCOPE. Apply, stating price, to this journal.

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PROF. J. E. TALMAGE, Salt Lake City, Utah.

FOR SALE—First-class duplicate objects, five for $1. You can get your objects in and class you may name, except pathological; but no time for lists. If you do not get $1 worth, money will be returned on day after slides are returned.
E. C. HOYT, 215 Howard St., Detroit, Mich.

FOR SALE—Vols. IV, V, VI, VII, of THE MICROSCOPE, bound in two volumes; fourth edition of Wyeth's "The Microscopist;" Marsh's "Section Cutting," and Phin's "How to Use the Microscope." For cash only.
H. M. RICHARDS, 27 Ellery St., Cambridge, Mass.

FOR SALE—A Bausch and Lomb Model Microscope (No. 521 of their catalogue), as good as new, having been used but a few times. There are two objectives, a 1 inch and a ¼ inch, one 2 inch eye-piece, camera lucida, etc. Everything in perfect order. Will be sold cheap. Correspondence solicited. Address,
S. G. ROBBINS, Siverly, Pa.

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W. E. SWIGERT, Spencer, Owen Co., Ind.

WANTED—Several good objectives and eye-pieces; must be in first-class condition. State full particulars. Also want unmounted material. Will exchange or buy. Correspondence invited. CHAS. VON EIFF, 20 Palmetto St., Brooklyn, N. Y.

WANTED—Histological and pathological material to cut on the halves. Nothing but first-class material desired. Address C. B. CLAPP, M. D., Danville, Ill.

RARE MOUNTS for sale or exchange: hair of *Ornithorhynchus paradoxus*; mummy cloth, three thousand years old; sections of bark from Charter Oak tree. Address
PROF. H. M. WHELPLEY, St. Louis, Mo.

FOR EXCHANGE OR SALE—For microscopical materials or offers: A good Toepler-Holtz Electrical Machine, 12½ inch revolving plate, and current breaker, Leyden jar, Geissler tubes and numerous other accessories, the whole costing about $60. Will exchange for a good microscope, and pay difference. Correspondence solicited.
F. F. WOOD, Prin. Blair Graded School, Blair, Wis.

FOR SALE—A B. & L. Section Cutter, glass top, and micrometer screw, in perfect order, good as new, cost $7.50; will sell for $5.
H. F. WEGENER, 1305 S. Tenth St., Denver, Col.

THE MICROSCOPE.

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Authors of papers will be supplied with twenty-five reprints free, *when the desire for such is stated on the manuscript.*

VOL. IX. TRENTON, N. J., SEPTEMBER, 1889. No. 9.

ORIGINAL COMMUNICATIONS.

THE STATOBLASTS OF OUR FRESH-WATER POLYZOA.

DR. ALFRED C. STOKES.

MICROSCOPISTS who devote even a portion of their spare time to the collection and investigation of pond life soon meet with the Polyzoa and their statoblasts. To the uninformed both the statoblasts, or winter eggs, and the mature animals, especially those which form great jelly-like masses, or even little drops of colorless or pinkish gelatine, are objects of wonder. Among those with so little knowledge of natural things that they must be classed even lower than the uninformed, these jelly-like masses are left to themselves after being called "spawn," a word popularly describing a multitude of creatures and objects which happen to be enclosed within a gelatinous domicile. The statoblasts fare better, since they are small, and inconspicuous except to the eyes of the microscopist. For the average observer they have no existence, yet I have known the statoblasts of one of our common Polyzoa (*Pectinatella*) to be formed in such profusion in the autumn, that the surface of a pond perhaps half an acre in extent, was as densely covered with them as the surface of the little pools along the rail-road is sometimes covered with cinder scales.

And as for the Polyzoa themselves, our common gelatinous form (*Pectinatella*) is, in its season, the autumn especially, to be found studding the leaflets of aquatic plants with jelly-like globules from the size of a pea to those of a boy's marble, and floating in submerged masses as large as the reader's head including his hat. Such "finds" are the occurrence of every autumn day in the writer's locality.

These pinkish or reddish jelly-like masses are the aggregated homes of the Polyzoa discovered by Dr. Joseph Leidy, and by him named *Pectinatella magnifica*. The mass does not surround a single individual animal, but it is secreted and used as a domicile by an innumerable host of the little creatures, whose structure is as interesting as their appearance is beautiful. It is from this colonial habit that the entire group of similar organisms has been named the Polyzoa, a Greek word meaning 'many animals.' *Pectinatella* is only a single genus of the order, while *Pectinatella magnifica* is the only known species of that genus, and one happily almost as common as the lilies that grow in the ponds with it. *Pectinatella*, however, is not the only genus that surrounds its colonies with jelly. There are two others, *Cristatella* and *Lophopus*, the latter not having been thus far found in this country. In England and in France, however, it occurs in some abundance, while *Pectinatella* has not yet been observed in either of those countries.

Cristatella is usually a collection of animals arranged in from three to eight rows within an oblong or oval ribbon-like jelly mass, the entire colony varying in length from one to six inches. It is not to be found freely floating, or even just submerged, as *Pectinatella* often is, for it has the interesting ability to move slowly forward. It is only occasionally seen in the writer's locality, for it is not very common here, and when observed it is usually clinging to the lower surface of water-soaked logs or sticks or twigs, or slowly travelling among the leaflets of aquatic plants. It is apparently not a believer in rapid transit, for one species can travel only a single inch in a day, while another form will in one day accomplish a journey whose extent will equal its own length. To know that it has moved, its position must be noted and again examined after an interval of several hours. Its movement cannot be perceived by the eye alone. The foot rule must be brought into use.

As *Cristatella* is a collection of sentient animals, a colony of creatures living permanently immersed within the jelly which their own bodies secrete, there arises an interesting query, probably impossible of solution at present, as to the method by which the selection of the route to be pursued is determined. They must necessarily be of the same mind, for rebellion at the extremities would result in a motionless existence, for a time at least, and a revolt in the centre would only entail a somewhat greater pulling strain on the front rows, and a little more pushing force at the rear. Even if the selection be left to the front or to the rear, how does the front or the rear transmit the decision? However, *Cristatella* is the travelling Polyzoan colony, and the only one. The others are all sedentary except when accidentally broken from their attachment.

Lophopus is described as a colorless, sac-like jelly-mass varying from one-tenth to one-half inch in diameter, and usually branching, especially when mature or old. It is found attached to the leaflets of the Duckmeat (*Lemna*), and is, as already stated, restricted to European waters.

There is another section of the Polyzoa, including those that live in social colonies, but which secrete long chitinous tubules in which they dwell. These tubules soon become brown if they are not so from the first, and they are more or less conspicuous objects on the under surface of submerged stones, floating logs, and similar supports. They form clusters of variously curved and twisted and branching tubules which, in some genera, are adherent for their whole length to the supporting object, while in others the branches are free to float in the currents while only the main portions of the domiciliary tubules are permanently adherent.

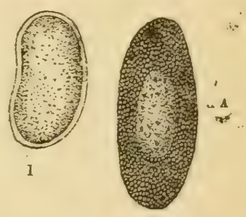

Fig. 1—Fredericella statoblast.
Fig. 2—Plumatella statoblast.
A—Annulus.

The members of another beautiful genus consist of a flexible sometimes branching cluster of urn-shaped cells, as if little vases were piled one on the other. The colony is attached only at the base, the remainder of the series of urns floating freely in the water, the animal protruding itself from the orifice of the terminal one. It is found in running water, attached to the lower surface of stones and rocks from which it hangs downward.

The Polyzoa are all easily visible to the naked eye, and common in shallow water or at the margins of deep ponds. They may be found in spring and summer in almost equal profusion, at least in the writer's locality.

The animals inhabiting the jelly masses or the chitinous tubules are timid creatures. When all is well with them, and they have no suspicion of lurking danger, a portion of each body is protruded into the water and the Polyzoan employs its time in searching for food. Light does not frighten them, although they live in secluded, partially darkened places; vibrations of the air, provided these can be felt, do not affect them; but the slightest jarring of the water, the smallest wave, or the most delicate ripple terrifies them and they fold together the protruded parts, and like the proverbial flash, leap backward into their jelly or their tubules.

Figs. 3 and 4—Two forms of Lophopus statoblast. A—Annulus.

About the only part of the body protruded beyond the orifice of the domiciliary cell is the portion called the lophophore. This is a circular or horse-shoe shaped region bearing on its upper surface one or two rows of long tentacles. These are flexible, entirely clothed with vibratile cilia, and each is movable independently of all the others. It is this tentacle-bearing lophophore that the microcopist sees when he waits until the animals have recovered from their fright, and have protruded themselves from their cells. They are so graceful in appearance, they add so much to the beauty of the animals, that the latter are among the most attractive of the larger microscopic and aquatic creatures.

At the centre of the lophophore a deep depression leads to the oral aperture, and the function of the ciliated tentacles is to collect the Infusoria and other small creatures upon which the Polyzoa feed. The very active cilia produce currents in the water that carry the food particles within the circle of the tentacles which, especially if the morsel is of some size, form themselves into a kind of cage or trap to prevent its escape, and the animal then takes care of it in a manner satisfactory to itself.

It is not the writer's purpose to describe in detail the structure and the habits of our fresh-water Polyzoan forms, but

chiefly to call attention to the statoblasts. That the reader may determine the genus to which his Polyzoan specimen may belong there is here reproduced, with a few changes, a Key which the writer originally published in *The Journal of the Trenton Natural History Society* for January, 1887, and which the editor of *The American Monthly Microscopical Journal* republished in June, 1888.

KEY TO GENERA OF FRESH-WATER POLYZOA.

§ Colonies formed of chitinous cells (a).
§ Colonies formed of gelatinous tubular cells (b).
§ Colonies a jelly-mass surrounding the polyps (c).
a Cells urn-shaped; lophophore subcircular; colonies pendent, ... *Urnatella.*
a Cells tubular; lophophore horse-shoe shaped, . *Plumatella.*
a Cells tubular; lophophore circular or oval, . . *Fredericella.*
a Cells clavate, growing end to end; lophophore circular, ... *Paludicella.*
b Branches not attached; lophophore horse-shoe shaped, , ... *Hyalinella.*
c Colonies more or less globular, permanently fixed (d).
c Colonies oval or elongate, slowly travelling, . . *Cristatella.*
d Colonies sacciform, finally lobed or branched. (Not found in this country,) . . . . *Lophopus.*
d Colonies globular, orifices grouped in lobed areolæ, . . *Pectinatella.*

One form of reproduction among the Polyzoa is by means of what are called statoblasts, or "winter eggs," because, being produced in the autumn, they remain unchanged through the winter, giving exit in the spring to the ciliated embryo that shall finally develop into the Polyzoan. It is these statoblasts that are so often seen as dark brown little bodies, thickly studding the surface of the half dead masses of Pectinatella jelly in September or later, and floating on the water, where they are frequently captured by the collecting microscopist.

Although small, the largest measuring perhaps 1-30 inch in diameter, their rich, dark brown color makes them easily visible, especially when in any abundance. As already stated, they are sometimes gathered with other aquatic objects and may be the cause of considerable mental trouble to the collector before he earns their source and meaning.

They are all oval or subcircular in outline, and very much flattened, while some are bordered by one or two rows of doubly barbed hooks, whose purpose, I imagine, may be to prevent the statoblast from being swept away by the currents, since the hooks form most effectual anchors. These marginal spines or double hooks are visible with a good pocket-lens, but on the majority there is a structure demanding the compound instrument for its elucidation. This is the annulus, a dark brown ring encircling the statoblast and composed of innumerable hexagonal cells. It occurs on all known forms except on those of a single genus, *Fredericella*, where the winter eggs are entirely smooth. There are, however, three genera which are not known to produce statoblasts, two foreign, *Norodonia*, from Siam and

Fig. 5—Pectinatella statoblast. Fig. 6—Cristatella statoblast, front view. Fig. 7—Cristatella statoblast, side qiew. A—Annulus.

China, and *Hislopia*, from central India, with the *Urnatella* of our own country. The latter is supposed to reproduce itself by means of the urn-shaped segments of the stem.

Within the body of each Polyzoan there is a cord-like structure extending from the lower end of the stomach to the bottom of the cell-like posterior part of the animal. This is named the funiculus, and from it the statoblasts are formed by a process of budding. "They arise," says Professor Alpheus Hyatt, "within bud-like swellings of the funiculus, and, enlarging, slowly push out to the surface of the cord, and upwards toward the stomach, until finally they hang upon the exterior, arranged alternately on either side, the youngest being at the lower end."

Each Polyzoan seems capable of producing only a limited number, yet the Polyzoa forming even a single colony are so numerous that the number produced is in the aggregate something astonishing.

They are never extruded from the living animal. When their formation is begun, the Polyzoan is approaching its death, and it is only after death that the statoblasts become freed from the body, the soft structures decaying and melting away, while the hardened, chitinous winter eggs float out, to remain quiescent during the cold of the season, and to have their contents start into activity with the warmth of spring.

Although the majority of the mature animals are permanently sedentary, the embryo as it leaves the statoblast is exceedingly lively, and as often happens among other of the lower animals it bears no resemblance to the parent. It is a ciliated creature that swims about actively for a time, eventually settling down to a quiet life, and developing into what the parent was before it. I have several times had the statoblasts give exit to these embryos in a small aquarium standing in a warm room during the winter, and they have finally attached themselves to the glass, where they seemed to the naked eye like transparent grains of rice; when carefully detached for the microscope, their appearance is always indescribably exquisite. Several of my friends have had a similar experience. In every case the statoblasts had been gathered accidentally with other materials, and left standing in the aquarium, where they probably mistook the warmth of the room for that of early spring.

The winter eggs of each Polyzoan genus are characteristic, and from the appearance of even a single one, if mature, its generic origin may be ascertained. It is to assist the microscopist in that determination that this paper is prepared. It is always a satisfaction to know a thing when it is seen, and to be able to give a positive answer to the oft-repeated question, "What is it?" And these little brown specks are sooner or later sure to bring out that question. By means of the subjoined Key and the figures of the statoblasts in the text, the origin of these winter eggs may be determined.

KEY TO THE STATOBLASTS OF THE FRESH-WATER POLYZOA.

A Reproduction probably by the urn-shaped segments of the stem, ... , *Urnatella.*

A Reproduction by statoblasts (a).

a Statoblasts without spines (b).

a Statoblasts with spinous margins (d).

b Without a cellular annulus, ... *Fredericella*, Fig. 1.

b With a cellular, dark brown annulus (c).

b With a cellular, purplish-blue, iridescent annulus,* . . *Paludicella.*

c Extremities rounded, ... *Plumatella,* Fig. 2.

c Extremities acute, sometimes prolonged . . . . . *Lophopus,* Figs. 3 and 4.†

d Spines in a single, marginal series, double-hooked, . . . *Pectinatella,* Fig. 5.

d Spines in two rows, variously hooked, ... *Cristatella,* Figs. 6 and 7.

TRENTON, N. J.

NOTES ON THE MICROSCOPE STAND, AND SOME OF ITS ACCESSORIES.

AN AMATEUR.

THE FOOT OR BASE.

UPON the material, whether brass or iron, from which the foot is made depends some of the cost of the stand and much of the weight, both being worth considering. So far as utility is concerned iron is as acceptable as brass, less attractive in appearance, and cheaper. It has been said that iron is as good for this purpose as brass provided the stand is not dropped, when an iron foot would be more likely to be broken. The man who drops his microscope, and risks such an accident, in my opinion does not deserve to have a microscope. A microscopist should be the most careful and patient of human beings. The beginner need never reject an otherwise acceptable stand because the foot is not of brass, but he should look to its form.

Most of the foreign stands, notably the modern ones of Zeiss, have the foot horse-shoe shaped, which fortunately has not become the custom among American opticians. The form is clumsy, ugly, and in no way essential to steadiness. To obtain the needed weight without too greatly enlarging the horse-shoe, it is made very thick, and to keep the stand properly balanced when inclined, the pillar is inserted close to the curve, leaving the two sides extending off into space as far as they are able, always reminding me of those people who try to grasp the unattainable and to reach after the infinite, while if they should cultivate a little more common sense, and be a little more practical,

*Parfitt. Ann. and Mag. Nat. Hist. 1866. p. 171.

†Not yet observed in this country.

they would be happier and their friends more comfortable. Those American microscopists who love everything German, are fond of these horse-shoes. Their liking may be a remnant of the superstition that a horse-shoe brings good luck. I can explain it on no other basis, for as a microscope foot, nothing can be more needless or foolish. If the reader has such a remnant in his blood, he would better tack the horse-shoe over his door, and select a microscope foot in the form of a flattened tripod.

Most of the American stands, even the cheapest, and most of the English, have the tripod base, which is all that can be desired. It is graceful, firm, and altogether acceptable. Some one has said that a foot of this shape needs to have only the tips of its toes in contact with the table to stand firmly. The horse-shoe base needs its entire lower surface in contact with the table, a kind of flat footed contrivance not wanted in this country, where it is well known that anything flat flooted is deficient in intellect.

The tripod base obtains its stability by its form and the extended area of its surface. It cannot be accidentally overturned, and it keeps the stand well and securely balanced at any angle of inclination, even when the body is in a horizontal position. Usually the truncated ends of the three arms have each a square toe beneath it so that the foot bears on the the table only at three points.

Another simple but admirable contrivance common to several first class American stands is a square board which is buttoned to the foot, thus insuring still greater stability, and forming not only an excellent means of support when the stand is to be carried around without the case, but an excellent means of sliding the whole into the case, where two lateral tongues should be arranged for it to glide on, with two grooves in the board to receive the cleats. Thus supplied the stand is never in danger of toppling over when carried about in the case. Makers would do well to add it to all stands, although every owner can easily make the addition for himself. Some microscope cases have buttons on the floor which are to be turned over the tripod arms to hold the stand in position, but they are a nuisance, especially when the microscopist is a little hurried, while if the stand is attached to the base-board it can be rapidly slid into position.

On the foot of first class stands like Bulloch's "Congress" and

Zentmayer's "Centennial," there is a revolving platform to which the pillars are attached, and whose bevelled and silvered edge is graduated in degrees for the measurement of the angle of aperture of objectives. Nothing of the kind is applied to the cheaper stands, but even without it the aperture may be measured with approximate correctness.

THE SUPPORTING PILLARS.

In some stands the single pillar is a straight cylindrical rod extending from the foot to the arm, to which it is attached at its upper end and which in its turn bears the body. This arrangement is common on French and German stands, which are therefore called the continental model. It necessitates a low instrument and a short body-tube, since the microscope must be used in a vertical position. This model is strongly advocated by some American microscopists whose backs must be like the one that Charles Dudley Warner wished for when he hoed his vegetables, as detailed in "My Summer in a Garden," for they must be of cast iron with a hinge in the middle. If the purchaser is wise he will not buy a stand made on the continental model. If he must use his microscope in a vertical position he can sit on a high stool with the instrument on a low table, and he will then get the back ache and a crick in his neck almost as soon as by using a stand with a rigid pillar. It seems better to put the hinge in the pillar so that the instrument may be inclined at a convenient angle, and to keep your vertebral column as Nature made it.

In the best and most complete stands where expense is not considered, the pillars are two, the arm swinging between them with a milled head on the outer side of each to clamp the instrument at any angle of inclination. This is an admirable contrivance not found on the smaller and cheaper stands. It obviates the trouble sometimes occasioned by the wear of the joint and its consequent looseness. In the least elaborate models the joint not only has no adjustment for wear, but the pillar is often single. There is no rule for this, however, among American manufacturers, as most of them make stands with either single or double pillars. To me the double pillars have always seemed preferable, although I have no very valid reason to give, except that an instrument perched at the summit of a single stem seems so insecure that I usually feel like steadying it with my hands.

The two supports are much more preferable, and in the end it might be to the optician's advantage to add them to all his stands. The extra cost could not be great.

In Messrs. Bausch and Lomb's list the cheapest and the most costly stands have double pillars, while the intermediate grades have but one. All of Mr. Gundlach's have the single pillar. All of Mr. Bulloch's designs, with one exception, have two. Messrs. J. W. Queen & Co.'s cheapest, even their cheapest "Acme," have two, while their more costly stands have one. Mr. Zentmayer's least and most expensive have two, while his intermediate has but one. The preference seems to be personal with the manufacturers, as it is with the writer; otherwise I am at a loss to understand the diversity to be noted in the foregoing list.

The origin of the double pillars is sufficiently curious to be mentioned. The improvement, which was made forty years ago or more, by George Jackson to whom we owe several important suggestions, is due to the fact that in one respect Jackson was not an accomplished workman, for he could not file well. Up to his time only a single pillar had been used, with a joint at the top, but Jackson wishing to made himself a stand, failed to procure acceptable results by filing out the parts of the joint, the only method of doing it, as plaining machines were then unknown. It therefore occurred to him that he might turn a horizontal axis, and support each end at the top of an upright pillar, which he did. The idea was adopted by several London manufacturers, and is now used for what the writer, at least, considers the most desirable stands.

The metal of the pillars may be either iron or brass, like the foot, the choice depending on the expense to be incurred.

Another method of suspending the instrument, an American device and adopted, so far as I know, by only two of our manufacturers and imitated by one in England, consists in making the arm a segment of a circle whose centre of curvature is at the centre of the stage. It has a groove on each side into which fit two tongues gliding in the grooves when the instrument is inclined, the friction being great enough to hold it at any point. If it becomes necessary to retain the arm more firmly in position, a tightening screw is provided. This is the "American Concentric Microscope," made by Messrs. Bausch and Lomb at the suggestion of the Hon. J. D. Cox.

The other model, the first as regards the invention, is Mr. George Wale's "New Working Microscope." It differs from the foregoing inasmuch as the foot and pillars are of iron, the pillars higher, the parts on each side being cast together so that they form two separable portions held by a screw. The grooves on the arm and the tongues on the pillars are essentially the same and have the same action as in the "American Concentric Microscope." In both the advantage claimed is that the centre of gravity remains at about the same point with any inclination of the body, while in the ordinary stands it changes more or less with the changing angle, and the stability of the former is said to be increased. The idea embodied is an excellent one, and the instruments are as valuable for useful working stands as any on the market. The form, especially of the "American Concentric" model, seems odd and unattractive, probably because it is uncommon, and this, in addition to its price, may have militated against it. Mr. Wale's stand is built of cheaper material in part and on different lines, but it is probably as desirable for the amateur as the more elaborate form. It is more graceful in appearance, but one objection to it is that the mirror cannot be rotated above the stage for the illumination of opaque objects. The stand was extensively advertised about ten years ago, and was received with approval, and imitated in England, but during recent years it has not been heard from, at least in this its native country. It might be advantageous to some dealer, or to Mr. George Wale himself, if the "New Working Microscope" could be revived.

THE ARM.

At the present day there is practically but one microscope arm in use by all the manufacturers. It of course differs in form with the various models as made by the various dealers, and it is of iron or brass, but so far as its connection with the body-tube is concerned, there is now really but one universal plan of accomplishing that object. This is the method devised by George Jackson, and called after his name, the Jackson model. In it the body-tube is, for the greater part of its length, supported by the elongated surface of the arm through the intermedium of the rack and pinion. This insures great steadiness of the body, both when the rack and pinion are in action, and when the microscope is subjected to the vibrations which are

constantly shaking a city house, or even the most secluded work table.

Many years ago what is called the "Ross Model" was used by Ross, of London, as his method of supporting the body-tube, although he did not originate it, and has now abandoned it for the Jackson method. In it the arm was produced horizontally, the extremity of this prolongation having inserted into it the lower end of the body-tube, all the rest of the body extending upward entirely without support. The rack, instead of being attached to the body and moved by a pinion within the arm, was cut in the side of the arm itself below the horizontal projection which bore the body-tube. The eye piece was at the long end of a lever, so that every vibration of the tube was transferred to its upper free end, and there greatly increased in effect; consequently, unless the workmanship was perfection, the image danced about in a most aggravating way. In Ross's stands, however, as made by himself, the workmanship was so super-excellent that but little dancing of the image occurred, unless the surroundings were exceedingly unfavorable. As the method is now universally abandoned, it has historic interest only.

The elongated surface in the Jackson model upon which the body bears by means of the rack, has been taken advantage of by the manufacturers to increase still further the steadiness of that part. Bulloch in his first-class stands cuts two V-shaped grooves the entire length of the part, into which fit and smoothly slide two V-shaped tongues attached to the body-tube, while the latter also bears a central projecting rib with two lateral flanges, all of which fit into corresponding grooves and depressions. Zentmayer's stands have a somewhat similar though less complex arrangement of projecting pieces and flanges, with the admirable addition of a spring so arranged as to bear continually upon the parts, and not only aid in the steadiness of the whole, but compensate for any loss by wear and tear. Other makers have adopted modifications of these plans which belong to all mechanics in common, and can be claimed as the device of no special one.

In the most desirable of our modern stands the arm carries the fine adjustment screw on its back, as well as the pinion of the coarse adjustment on the front, while in the majority it also bears the mirror bar and often the sub-stage apparatus, besides

supporting the whole instrument above the pillars. In the anatomy of the stand the arm is therefore one of the most important members.

THE BODY.

I do not suppose that even the most economical manufacturer has ever thought of forming a microscope body of sheet iron. The material is always brass. In a single instance only, so far as I know, an entire stand has been made of silver. This was done by Messrs. R. & J. Beck, of London, for a gentleman in New Orleans. Like diamond lenses, silver stands are for the few, and probably only the minority would care for them. Modern objectives of glass are far superior to objectives of diamond, and silver as a material for a stand is about as undesirable as can be imagined. Sheet iron would probably be more serviceable.

No manufacturer makes the body of a length and diameter equal to the length and diameter of the body-tube of any other manufacturer; and some makers have as many as three sizes, so far at least as regards the diameter, while the variation in length is almost as great. This gives trouble when it is desired to use the eye-pieces of one optician on the stands of another, and necessitates a special fitting for the eye-pieces, unless the purchaser is willing to use those accompanying his stand, as he usually is until he wants a "solid," a "periscopic," or some other variety. Then, if the tube is too large, the eye-piece must have an adapter of brass applied by the dealer, to prevent it from fitting too loosely and from slipping to one side when the microscope is inclined, and from thus falling too far from the optic centre; or it must be wound around with paper, a device that I have tried successfully more than once. But if the tube is too small to receive the eye-piece, the microscopist begins to appreciate the trouble of non-uniformity in the size of all eye-pieces and of all body-tubes. The desirability of this uniformity has long been recognized, and the American Society of Microscopists has distinguished itself by its continued efforts to accomplish the change from this variety of sizes to one standard. The attempts and recommendations have been toward a standard size for the eye-piece particularly, which of course necessitates a uniform diameter of the body-tube. This uniformity, however, will never come until the clamor of purchasers forces the dealers

to supply it. The American Society of Microscopists suggests that eye-pieces be one and one-fourth inches in diameter, which of course means a body-tube slightly larger. One English firm makes eye-pieces one and one-fourth, one and five-eighths and one and seven-eighths inches in diameter, with body-tubes of corresponding sizes. Why a single size only should not be made, the firm alone knows. The diameter of the tube on my own stand, from a prominent American maker, is one and eight-twentieths inches, or only three-twentieths greater than the standard recommended by the American Society for eye-pieces, yet I doubt if that maker would willingly alter his pattern even by so little; and a solid one-half inch eye-piece from Mr. Tolles is only one and one-twentieth inches in diameter, demanding a wealth of paper wrapped around it to make it usable on my stand. This is hardly a valid criticism, however, since the solid eye-pieces of all opticians who make them, are expected to be supplied with an adapter to fit the body-tube.

The purchaser of a stand should select the one with the widest body. There is no objection to the use of an adapter on a small eye-piece to make it fit a large tube, nor even to the application of a paper bandage for the same purpose, since the microscopist can himself apply the latter with a successful issue. If each turn of the stout paper band is well coated with mucilage, the cylinder thus formed will, when dry, be almost as hard as wood, and if injured may be easily reapplied without cost.

There is already a standard for the length of the body. It is ten inches, or the same as the arbitrary standard for normal distinct vision. Yet at the present day it would seem that most makers do their best to have the body less than the standard length. In some instruments it is only one and one-half inches less, the proper length being obtained by pulling out the draw-tube. It is true that the short tubes are used on the continental stands, and on those modelled after them, and there they are necessary, since the pillar has no joint for inclination, the microscopist being forced to use the instrment in a vertical position. If human necks and backs were made of India rubber, then those microscopists who use and recommend stands with short bodies, might join the majority of working microscopists and elongate their necks over the standard tubes in a vertical position. But since human vertebræ are not elastic, this class of micro-

scopists must have short body-tubes, and not only lose considerably more than they gain, but also injure ignorant beginners who go to them for advice, and are sent to Europe for stands made after the continental model. In this country, except among a few, these short body-tubes are not favored. Yet many manufacturers place them on their stands, supplying also a draw-tube which is really a part of the body, since it must be pulled out to obtain a body of the standard length, the draw-tube in reality being absent.

The magnifying power of the combined eye-piece and objective may be lessened by shortening the body, and greatly increased by lengthening it, so that it would seem an advantage if a lower power could be obtained by the short body, and a higher power by drawing out the tube to the standard length, the same objective being used in both cases. It would seem that as much could be obtained in this way from one objective as from two used on a standard body. To a certain extent this is true. With bodies of the standard length, in which a draw-tube will generally be found, the power may be enormously increased by the use of the draw-tube, yet the result is anything but desirable or praiseworthy. The standard body, however, cannot be shortened, yet in many instruments, always in the best ones, there is a diaphragm within the body to which very low power objectives may be attached, and a very low magnifying power thus obtained. Even here, however, the result is gratifying only in objectives of very low power, and the reason for it is the same that holds good in the attempt to obtain two or more degrees of amplification from the same objective by the use of a short body lengthened by drawing out the tube to the standard.

There are several kinds of objectives, but the two great divisions, into one of which all must be classed, are adjustable and non-adjustable. That is, for certain optical reasons, the adjustable objectives are supplied with a rotating collar which, when turned moves a part of the compound lens, the position of the other parts remaining unchanged. This affects for the better the appearance of the image, and is always present on the best objectives, except on some of the apochromatics of Zeiss, where it ought to be. In the non-adjustable objectives the lenses composing them are immovable, being firmly fastened to the brass mounting by the optician. These are not so valuable in an

optical way as the adjustable forms, because they have no means of correction for certain changes in the image produced by covering the object to be examined by the thin glass always employed for the latter purpose, and because they must always be used as the maker decided to be best, whereas many contingencies arise that he has not provided for, when the adjustment becomes necessary, if the microscopist desires a fine image. When he makes the non-adjustable objectives the optician fastens the component lenses in the position that gives the best image with a certain length of the body-tube, but what that length was we often have no means of knowing, although we may be certain that it was nearer ten inches, the standard length, than the five or six of the short tubes. But if the non-adjustable objectives are permanently adjusted by the optician for a certain length of body, would even the beginner in the use of the microscope suppose that such objectives would give as good an image when used on a tube of any other length? If he should imagine that he would be mistaken. No two persons can use the opera-glass or spy-glass in succession without changing the focus, or the relation of the lenses to each other, because no two persons have precisely the same excellence of eye-sight, or the same focus to their eyes. And it also happens that non-adjustable objectives made to be used on a ten inch body will fail in some important particulars when used on a shorter tube; and one prepared for a short tube will fail in some of its fine points when employed on a long body. In adjustable objectives these difficulties may be overcome by separating or approximating the component lenses by turning the collar, that is, the objective may be corrected, but in the non-adjustable objectives the microscopist who has trained his eye for perfect images of the object examined, will be forced to take what he may get, with no power to better the result. For this reason the short body-tubes are objectionable. Zeiss, in his English circular, refering to his apochromatic objectives, says:

"The objectives are made either for a tube length of 160 mm., or of 250 mm., with the exception of the three of 6 mm., 12 mm. and 24 mm. focus, which are exclusively for the tube of 250 mm., these lenses not being so favorable for the shorter tube. It is important that the length of tube be kept in consideration, because any change in same will considerably diminish the per-

formance of these objectives, especially for those for homogene immersion."

When used with short tubes the performance of all objectives is affected in ways that are objectionable, but in ways that the beginner would not notice for himself. When the tube varies but little from the standard, the bad effects are not so great nor so noticeable; it is only on the very short bodies that they become prominent. When the non-adjustable objectives are used on standard bodies and the draw-tube is much extended, the results are equally bad, and the beginner will often read of objectives "not bearing" such treatment, and "breaking down," which means that the image becomes so altered for the worse that it is worthless. This difficulty can never be feared in stands supplied with a short body which must have the draw-tube extended to obtain the standard length, but only on ten inch bodies when lengthened by the draw-tube. Neither will any of the troubles referred to be incurred to nearly so great an extent with low power objectives, such as the five, three, two or one inch, which, even the very best made by any optician, are always non-adjustable. It is with the higher powers, the one-fifth, one-fourth and higher, that the results become objectionable. But, as already said, the beginner would not notice the objectionable features introduced by changing the length of the tube; he would only be likely to see the alteration in the magnifying power.

For these reasons the beginner would do well to reject an instrument whose body is much shorter than the standard length of ten inches, unless he wants his microscope as a toy to be played with for a short time, and to be then packed away on a shelf and forgotten. If he wants it for the examination of the exquisite beauties in Nature, if he intends to do any original investigation with it, then he most surely should avoid a stand with a short tube. And if he expects ever to use good objectives, if he expects his microscopical education ever to be improved, if he does not expect always to remain studying the microscopical alphabet, then I would, as a disinterested adviser, earnestly urge him to avoid a stand with a very short body-tube. These chapters are written for those beginners who have some serious purpose in view when they buy a microscope; something more serious, indeed, than mere amusement, although there is nothing

in the world from which better and more innocent amusement may be obtained than from the microscope. They are written for those who desire something more and higher than simple amusement, and such readers I would advise to select a stand with a body of the regulation length.

Aside from the elements of optical discord introduced by using on a short body non-adjustable objectives corrected for a long one, there is another objectionable feature about the short tubes. The constant manipulation of the draw-tube to alter the magnifying power is pretty sure to strain the fine adjustment mechanism, if the latter is at the back of the arm, as it is in most stands recently made. It will also have more or less of deleterious effect on the coarse adjustment, although there it will not be so great.

(*To be continued.*)

SECTION CUTTING IN THE COLD.

DR. HENRY SHIMER.

FEBRUARY 12.—We are up at daylight this morning to cut those specimens of rabbits' lungs and liver which we hung out at 1 A. M., by a thread, on a nail, in anticipation of a good morning for this work.

Thermometer being at 4° above zero, the lungs are frozen just right, and we soon have a supply of fairly good specimens for study. They are not quite so thin as we read about, but still useful as helps in our studies in histology.

FEB. 13.—We attempt to repeat our work of yesterday morning, having spoiled some of the specimens in staining with hæmatoxylin, for this valuable stain is much more difficult to work with than the carmines ; is easily overdone and often precipitates in a fine powder, ruining the specimen. The morning is too warm, being 15°, soon 20° above zero, so we get but few specimens and they are too thick to be very useful.

We get the best results by cutting in a temperature near zero, say from 5° below to 10° above.

During the past winter I have thus cut, out-of-doors, one hundred different pieces of animal tissues, averaging about fifty sections from each, with very satisfactory results, to myself at least.

I have never found it too cold for good cutting of fresh tissues. I was once cutting the tuberculous lung of a rabbit, with the temperature 30° below zero. This became too hard, and the razor jumped and the edge turned. Fresh tissues, at zero, cut as nicely as old cheese; then drop them into a saucer or cup of water.

Water-soaked and diseased tissues do not work so well. Tissues preserved in alcohol may be soaked out in water and frozen, but they become too hard at zero. They may be cut in a temperature of 20° to 30° above, but I failed to get such satisfactory results as with the fresh specimens at zero.

In this way it is no trouble to make sections of animal tissues in this country where all out-of-doors is a great freezing microtome. Almost any morning for three winter months, I cut with a dry razor; and if there is no wind, the sections may be let fall on a piece of paper and rolled up like cigars. When done, turn them into a saucer of water when they will immediately spread out flat.

I find this the cheapest, easiest and best method of sectioning frozen tissues that are fresh, with the animal juices all in, for such do not freeze so readily, nor so hard as water-soaked specimens. It is, too, a method at the command of every one who owns a razor.

The specimen, when sectioning, must be held in a hand microtome, or in some other way, as between two pieces of corn pith, or even two light flat pieces of wood. It cannot be held in the fingers for obvious reasons.

These specimens do not mount very well in balsam. The alcohol and turpentine processes contract and distort them too much for satisfactory slides. Farrant's medium or glycerine jelly is better.

Many years ago I felt a desire for specimens of my own hands' working for my microscope. Then we had no teachers of this art in the medical colleges, and the works of Hogg, Carpenter, and others on the microscope were not well calculated to inspire the entirely inexperienced. They told us to clip off pieces with the scissors for temporary study. The hardening process we did not understand, and thus twenty to thirty years ago we were without specimens, except such as were made by experts for sale. Thus we were taught that only a few persons could do such work, and we consequently lost the opportunities

at our command, in a country where cold is plenty and cheap for three or four months in the year, so that we can demonstrate the histology of most of the animal tissues, excepting such as the eye and brain. This is a method at the command of every one, without the expensive outfit of a good working laboratory; and one by which every person, who has the least ambition, can make most of the slides he may need.

NOTES ON BALSAM BOTTLES.

W. N. SHERMAN, M. D.

IN the *National Druggist* of July 1, I have noted a paragraph under Microscopy, explaining a very simple and effectua device for preventing the smearing of balsam and other resinous and sticky substances, with the consequent adhesion of the cork, to the neck of the bottle.

A piece of soft whalebone is bent and placed in the bottle, so that superflous fluid may be removed on its arch. This impressed me as quite a practical idea, as several of my bottles have been spoiled by having the cork stick to the neck. But I want to suggest a better plan.

One can buy at any dental depot a nice glass-capped bottle for $1.20 per dozen or for ten cents each, or any dentist will get them if asked. The mouth and cap are ground, and fit together nicely. This is superior to other forms because of its shape, being wide at the bottom, and not easily overturned. Its cheapness, too, is a great consideration, as five may be obtained for the cost of one of the other form, when purchased of dealers in microscopical apparatus.

By placing a small piece of card board on the pencil handle, and allowing it to rest on the neck of the bottle, it will serve to keep the brush from the bottom, and the hairs will remain straight and in good working order. The brush is drained on the inside of the neck, and no trouble is experienced from "sticky" corks.—EDITORIAL.

EDITORIAL.

VALEDICTORY.

JUST three years ago the undersigned entered into full possession of THE MICROSCOPE, a journal, which at that time was in a most precarious condition, as all old subscribers can testifiy.

Money and hard work have revolutionized the publication, the demands of which have, however, now so far outgrown the limited time which is at our disposal to devote to editorial work, that, in the interest alike of subscribers and advertisers we have deemed a change of proprietorship absolutely essential.

We drop the pen with many regrets; for the kindly manner in which our efforts to raise THE MICROSCOPE to the position which it now occupies (the leading journal of its class on the continent) have been received and encouraged, and the many friendships formed during our editorial management, have endeared the journal to us, until it has become almost part and parcel of our lives.

Dr. Alfred C. Stokes, well known to all of our readers as a microscopist of wide reputation, assumes charge of the journal with this issue. Under his manegement THE MICROSCOPE will be greatly improved in all points, and will continue true to its high scientific standard.

Mr. F. A. Lucas, the publisher, has a well-earned reputation as an art printer, so that the make-up and typography will continue as heretofore, unexcelled.

In relinquishing our control of THE MICROSCOPE, we desire to express our thanks and appreciation for all the kindly support received during our administration, and we ask that microscopists will still continue their favors towards the Journal.

W. P. MANTON.
GEORGE DUFFIELD.
FRANK W. BROWN.
CHARLES G. JENNINGS.

DETROIT, Mich., Aug. 30, 1889.

SALUTATORY.

FOR the second time in its ten years of life THE MICROSCOPE suffers an editorial change. Founded by Dr. and Mrs. C. H. Stowell, of Ann Arbor, it from the first attracted considerable attention as a bright and always welcome journal. For about six years Dr. Stowell conducted it with skill, making it more and more influential and helpful. When it became necessary for him to relinquish the editorial care, the journal at once advanced to a still higher plane under the leadership of Dr. W. P. Manton and his accomplished associates. And now, for reasons already explained by the retiring editors, THE MICROSCOPE again changes hands, but whether for the better the future alone can tell. It will not suffer a sea change into something new and rare, for the present editor will need to work to keep the journal where Dr. Manton leaves it.

The editorship is assumed after a good deal of hesitation and reluctance. For several years the writer has contributed to the journal's pages, whether acceptably or not to the journal's readers there is no means of knowing. But he is presumably not an entire stranger to the reader, yet the latter need not be frightened, for the editor seldom contributes to the pages of his own paper. A magazine could discover no more effectual method of disposing of a persistent contributor than by making him the editor. If he should be so utterly uncontrolable as to insist upon printing an occasional effusion and labelling it "editorial," nobody need read it. There every one has a defence, whereas an article in the body of the journal forces itself upon the reader and demands some sort of attention. Conse, quently, although the writer has been quite frequently a contributor to THE MICROSCOPE, he hopes to be forgiven, since he may not do so any more. With him it will be (perhaps) hail, and farewell.

The magazine will be just what its friends make it, and the editor will, with their aid, endeavor to hold it in the position to which it has attained under his predecessors' care.

His chief desire will be to keep it helpful and inspiring. Many an owner of an instrument is as at loss for something to do. His knowledge may not be great enough to show him what fields of microscopic research are open to cultivation by him; indeed, he may not know into what path to step so that he may reach a region whose distant and well cultivated prospect seems pleasant. THE MICROSCOPE will be happy if it can even accidentally direct such inquirers. The owner of an instrument need not sigh for the realms of original research. There is enough in the little things overlooked or intentionally left by the giants of science, to occupy the time and attention of almost any microscopist for a life of spare moments.

A facetious landlord is said to have erected a notice to the effect that "If you don't see what you want, ask for it." That will be one of the notices to remain standing at the head of these columns. Although invisible to the naked eye, the reader may fell sure that the request is there, and that any suggestion from any one, although he may have only just bought his first microscope, will be welcome, and will receive every possible attention. If matters get too dry and lifeless for pleasant assimilation, say so in plain English; but, at the same time tell the unhappy editor how to turn on the moistening and revivifying stream. And help him yourself to do so. If you write to this unfortunate being (I am already beginning to pity him, because I foresee that he will have a hard time of it), to tell him how you can "blacken brass by the use of emery," give him the particulars so that he may print your experience for the benefit of others. .

If suggestions and requests for microscopical help will be welcome, equally so will be essays, papers and contributions upon any of the multitudinous subjects pertaining to the department of microscopy. However unimportant an item may seem to its writer or originator, it may prove to be the link needed to complete the chain in the hands of some other worker; and however insignificant may appear the little "dodge" which its inventor

has found useful, it may be just what some one less thoughtful and inventive needs to further his researches. Because an object or item seems small to one, is no reason that it should be small to another.

With these aims and hopes and helps, THE MICROSCOPE begins its new life at a distance from its birth-place and the home of its maturity. A "change of air" is often beneficial. May it be so in this case; and as says tiny Tim, "God bless us, every one!"

ZOOLOGY.

REPRODUCTION OF CERATIUM.—Until quite recently the members of the genus *Ceratium* have been described as Infusoria, but at present some investigators consider them to belong to the vegetable kingdom, one form, *Ceratium hirundinella* (Mull.) Bergh, being common in the water suply of San Francisco, and sparingly found in that of New York city. M. E. Penard has been studying the reproduction of some of the species. He has observed the formation during the summer, of internal embryos, elliptical in shape, and possessing chlorophyll, an eye-like pigment spot and a nucleus. They escape, become encysted and pass through a resting state. A second method is by the production of two swarm spores, whose fate was not determined: and lastly, reproduction takes place by fission.

THE CONTRACTILE VESICLE.—Until within a short time the contractile vacuole has been supposed to be confined to the lower animal organisms, its possession by *Volvox globator* being one reason for relegating the creature among the animals, whereas the earlier investigators decided it to be a plant. Prof. M. M. Hartog, however, states, in *Nature*, that all naked protoplasmic bodies living in fresh water have at least one contractile vacuole, and that this is entirely independent of the possessor's systematic position.

BOTANY.

THE CYCLOSIS WITHIN THE NETTLE HAIR AND OTHER VEGETABLE CELLS.—You are doubtless aware that the common nettle owes its stinging property to the innumerable stiff and needle-like, though

exquisitely delicate hairs, which cover its surface. Each stinging needle tapers from a broad base to a slender summit, which though rounded at the end, is of such microscopic fineness that it readily penetrates and breaks off in the skin. The whole hair consists of a very delicate outer case of wood, closely applied to the inner surface of which is a layer of semi-fluid matter, full of innumerable granules of extreme minuteness. This semi-fluid lining is protoplasm, which thus constitutes a kind of bag, full of a limpid liquid, and roughly corresponding in form with the interior of the hair which it fills. When viewed with a sufficiently high magnifying power, this protoplasmic layer of the nettle hair is seen to be in a condition of unceasing activity. Local contractions of the whole thickness of its substance pass slowly and gradually from point to point, and give rise to the appearance of progressive waves, just as the bending of successive stalks of corn by a breeze produces the apparent billows of a corn field. But, in addition to these movements, and independently of them, the granules are driven, in relatively rapid streams, through channels in the protoplasm which seem to have a considerable amount of persistence. Most commonly, the currents in adjacent parts of the protoplasm take similar directions; and thus there is a general stream up one side of the hair and down the other. But this does not prevent the existence of partial currents which take different routes; and sometimes trains of granules may be seen coursing swiftly in opposite directions, within a twenty-thousandth of an inch of one another; while occasionally opposite streams come into direct collision, and after a longer or a shorter struggle, one predominates. The cause of these currents seems to lie in contractions of the protoplasm which bounds the channels in which they flow, but which are so minute that the best microscopes show only their effects, and not themselves.

The spectacle afforded by the wonderful energies prisoned within the compass of the microscopic hair of a plant, which we commonly regard as a merely passive organism, is not easily forgotten by one who has watched its display continued hour after hour, without pause or sign of weakening. The possible complexity of many other organic forms, seemingly as simple as the protoplasm of the nettle, dawns upon one; and the comparison of such a protoplasm to a body with an internal circulation,

which has been put forward by an eminent physiologist, loses much of its startling character. Currents similar to those of the hairs of the nettle have been observed in a great multitude of very different plants, and weighty authorities have suggested that they probably occur in all young vegetable cells. If such be the case, the wonderful noon-day silence of the tropical forest is, after all, due only to the dullness of our hearing; and could our ears catch the murmer of these tiny maelstroms, as they whirl in the innumerable myriads of living cells which constitute each tree, we should be stunned, as with the roar of a great city.—*Huxley*.

MICROSCOPY.

DISSECTING KNIVES.—The delicate blades of small dissecting knives are liable to become injured, if the instruments are not carefully cared for when nct in use. I find, says Prof. H. M. Whelpley, that a small piece of thick blotting paper can be slipped over the blade like a sheath to a sword. If the knife is dipped in vaseline before putting it away there will be no danger from rust.

FIXING OBJECTS TO THE COVER GLASS.*—Dr. Von Sehlen fixes samples of fluid or any non-viscous matter to cover-glasses by means of albumen. The albumen mixture is made by mixing the white of an egg with an equal quantity of cold saturated boracic acid solution (about four per cent. of the acid). If after being kept, a precipitate is thrown down, the solution is cleared by filtration.

The solution is merely dropped on the cover-glass, and some of the material is intimately mixed with it. An even layer is then made in the usual manner, and the cover-glass dried in the air and fixed in the flame.

TO DISTRIBUTE DIATOMS ON THE COVER GLASS.—In the *Journa de Micrographie*, M. B. de Langibaudiére suggests the following method of distributing the Diatoms over the cover. Several drops of distilled water are placed on a cover-glass which has been previously laid upon a metal table. The Diatoms are preserved in alcohol, and a drop is removed and allowed to fall into

*Journ. R. M. S. From Centralb. f. Bakteriol. u. Parasitenk.

the distilled water on the cover. Owing to the rapid motion produced by the union of the water and the alcohol the Diatoms are scattered over the glass. The metal table is then heated, but so gently as to avoid boiling the water, and the Diatoms subsequently mounted in the usual way.

COLLECTING SALT-WATER SPONGES.—Mr. W. B. Hardy recommends† that the collector should start about an hour and a half before low water, so as to be on the ground a full hour before the tide commences to rise again, and choosing some sheltered nook among the rocks if the coast be a rocky one, or about the piles of a pier if it be an open one. There he will be sure to find attached to the under surface of inclined stones, in clefts and cranies of the rocks, about the roots of the sea-weed, in short, in any sheltered spot where there is a good surface for attachment and where the sun does not strike too strongly, tenacious masses of a sponge-yellow, green, brown, or orange color, and with large orifices on the surface. These are the easily recognized objects for which search is being made.

Pieces of the sponge should be removed as completely as possible and taken home in a considerable quantity of fresh sea water. A pocket lens, a couple of needles mounted in holders, a pipette, and a microscope with a few cover glasses and slips are all that is required for the first examination.

A sponge is composed of sponge flesh supported by a skeleton. The latter is composed of a network of delicate needles, gathered into interlacing bundles; the sponge flesh forms a mass which contains imbedded in it the skeleton, and is also honeycombed by a system of canals and spaces, all in complete intercommunication, the canal system. One extreme of the canal system is the pores, the other the oscula; and through it a continual stream of water is flowing during the life of the animal, setting in from the pores to the oscula. The current is maintained by the action of flagella situated on the cells lining certain enlargements in the course of the canals, known as the flagellated chambers.

METHOD OF INVESTIGATING CYCLOPS.*—In his researches into the morphology of *Cyclops*, Prof. M. M. Hartog sometimes found it necessary to examine live specimens; undue pressure was

†Science Gossip, Jan. 1889.

*Journ. R. M. S. From Trans. Linn. Soc. Lond.

avoided by putting under the cover a frond or two of *Lemna;* this arrangement has the advantage that by a push at the edge of the cover the *Cyclops* can be rolled over. The Abbe condenser was found invaluable. For dissection French spear-head needles were used; the parts are best seen in water after treatment of the fresh animal with ammonia.

NEW PUBLICATIONS.

SURGICAL BACTERIOLOGY.— By Nicholas Senn, M. D., Ph. D. Cloth, pp. 17, 270. Lea Brothers & Co., Philadelphia. This work is one of the most extensive on the subject which has originated in this country. Dr. Senn has long been known as one of the foremost of American investigators in surgery, and this latest result of his efforts should receive a careful reading, not only from surgeons, to whom it is more especially addressed, but by physicians as well. The writer, like nearly all the advanced workers in pathology of the present day, is a firm believer in the bacterial origin of many if not all of the infectious diseases; and yet he is one, of whom there are too few, who possesses that healthy conservatism so necessary to check the over-exuberant growth of a newly-developed field. This volume is intended as a record of reliable results obtained at the present time, and when there is still some doubt, however slight, the fact is mentioned. The work is superbly illustrated with reproductions from Klebs' *Lehrbuch des Pathologischen Anatomie*, and is in every way worthy of the publishers.

HOW TO CONDUCT A QUIZ CLASS.—By H. M. Whelpley, Ph. G., F. R. M. S. Reprint.

ON THE GUSTATORY ORGANS OF ARCTOMYS MONAX.—By Frederick Tuckerman. Reprint.

CONSTITUTION AND BY-LAWS OF THE ST. LOUIS CLUB OF MICROSCOPISTS.—Organized May 7, 1887.

PROSPECTUS OF THE ST. LOUIS COLLEGE OF PHARMACY.—Twenty-fourth annual session, from October, 1889, to March, 1890.

ON A FOSSIL MARINE DIATOMACEOUS DEPOSIT FROM ATLANTIC CITY, N. J., I., II.—By C. Henry Kain and E. A. Schultze. Reprint.

CORRESPONDENCE.

EDITOR THE MICROSCOPE.—Mr. Latham, in his article on the structure of muscle, in your last issue, makes no mention of the fibrillæ of striated muscle. Some years ago I accidentally hit upon a convenient object for demonstrating these in the fresh state, which may not be generally known. The large thoracic wing-muscles of the flies separate with the greatest readiness, on teasing, into fibrillæ showing the transverse markings. The blue-bottle fly is convenient on account of its size, but the house-fly will answer the purpose almost as well.

W. L. WORCESTER, M. D.

EDITOR THE MICROSCOPE.—Owing to the sale of THE MICROSCOPE announced in this issue, the agency for the sale of my rulings is, with the consent of the former proprietors of this journal, hereby revoked.

All orders and correspondence should hereafter be forwarded to me.

MARSHALL D. EWELL,
97 Clark Street, Chicago, Ill.

NEWS AND NOTES.

Dr. K. Krapelin has published a monograph of the fresh water Polyzoa of Germany.

The entire edition of the concluding volume of the "Challenger Reports" is said to have been lost at sea.

Mr. John Ralfs, who was one of the earliest of the students of the Desmids and the Diatoms in England, is dead at the age of eighty-two years.

In the *Journal of the Royal Microscopical Society* for December, 1888, Mr. John Rattray publishes "A Revision of the Genus Auliscus," with six plates and artificial keys to the species of these beautiful Diatoms.

The twelfth annual meeting of the American Society of Microscopists, which was recently held at Buffalo, is said to have been of unusual interest and importance. Dr. George E. Fell, the well known microscopist, of Buffalo, was elected president.

A delightful study of animal life and character is contributed by Oliver Thorne Miller to the September *Popular Science Monthly*, in the shape of a description of a pet lemur which the author possessed, and which represents a group of animals closely allied to the monkeys.

The proceedings of the American Society of Microscopists for former years, and for the present one when issued, may be obtained from the treasurer and custodian, Mr. C. C. Mellor, of Pittsburgh, who will answer all communications and transact all business in connection with them.

Rev. Francis Wolle, the accomplished author of "The Desmids of the United States," and "The Fresh-water Algæ of the United States," has an illustrated monograph on the Diatoms of North America in the course of preparation, with the probability that it will be ready for publication within a year.

It is said that Dr. Maliconico, of Naples, has discovered the microbe of old age. Now if some body will be kind enough to discover the microbe that shall kill the old age microbe, mix one or two of them with the Brown-Séquard elixir, and hypodermically inject us all, the world will take on a new aspect. As it is things are getting exquisitely funny.

Dr. Ferdinand Hueppe, of Wiesbaden, has been appointed Professor of Hygiene at Prague. He is the sixth of Robert Koch's pupils, says the *Baltimore Medical Journal*, who has been appointed to a professorship. The other five are Gaffky, of Giessen; Wolffhuegel, of Gottingen; Loeffler, of Greifswald; Gaertner, of Jena, and Berahard Fischer, of Kiel.

Robert H. Lamborn has placed in the hands of Morris K. Jessup, of the American Museum of Natural History, New York, the sum of $200, to be paid in three prizes of $150, $30, and $20, for the three best essays on the destruction of mosquitoes and flies by other insects. It is suggested that the dragon fly is an active, voracious and harmless "mosquito hawk," and that it might, if artificially multiplied, diminish the number of smaller insects. A practical plan is called for in the breeding of the dragon fly or other such destroyer in large numbers, and its use in the larva, pupa or perfect state, for the destruction of mosquitoes and flies in houses, cities and neighborhoods.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS who have microscopical apparatus. material or books which they wish to exchange, and such wants will be INSERTED FREE OF CHARGE. The number of insertions given will depend upon the number of exchanges received each month. Subscribers will please notify us when articles have been exchanged or sold. Dealers are referred to our advertising department.

FOR SALE CHEAP—A Beck's Economic Binocular, in perfect condition, complete, with four eye-pieces and one-sixth inch objective, for $70. Address.
L. M. King, Santa Rosa, Cal.

FOR SALE CHEAP—A Bausch & Lomb Polariscope in first-class condition.
Address W. J., 32 West Noble St., Columbus, Ohio.

TO EXCHANGE—Vols. V and VI of THE MICROSCOPE, which I will sell for $2.50 and take cover-glasses as pay—½ and ¾, and some square.
A. Miller, North Manchester, Ind.

FOR EXCHANGE—A Hailes' "Poly-Microtome" (an automatic microtome for freezing or paraffine-embeddiug), in exchange for a Kodak camera, or other good "detective."
C. E. Hanaman, Box 27, Troy, N. Y.

WANTED—A copy of each of the following numbers of "Microscopical Bulletin:" Vol. I, No. 5, August, 1884, and Vol. II, No 1, February, 1885. For either of them I will send a first-class microscopic slide, or for both I will send three slides.
M. S. Wiard, New Britain, Conn.

FOR SALE CHEAP—A Bausch & Lomb Universal Microscope complete, with objectives and accessories, perfectly new. Address,
Prof. C. F. Emery, Ocean Springs, Miss.

FOR EXCHANGE—A large variety of minerals and rocks, some polished; also fossils and reptiles in fluid, for mounts. Address,
Prof. J. E. Talmage, Salt Lake City, Utah.

FOR SALE—First-class duplicate objects, five for $1. You can get your objects in any class you may name, except pathological; but no time for lists. If you do not get $1 worth, money will be returned on day after slides are returned.
E. C. Hoyt, 215 Howard St., Detroit, Mich.

FOR SALE—Vols. IV, V, VI, VII, of THE MICROSCOPE, bound in two volumes; fourth edition of Wyeth's "The Microscopist;" Marsh's "Section Cutting," and Phin's "How to Use the Microscope." For cash only.
H. M. Richards, 27 Ellery St., Cambridge, Mass.

FOR SALE—Bausch & Lomb Model Microscope (No. 521 of their catalogue), as good as new, having been used but a few times. There are two objectives, a 1 inch and a ¼ inch, one 2 inch eye-piece, camera lucida, etc. Everything in perfect order. Will be sold cheap. Correspondence solicited. Address,
S. G. Robbins, Sivery. Pa.

WANTED—THE MICROSCOPE, Vol. I to IV inclusive.
W. E. Swigert, Spencer, Owen Co., Ind.

WANTED—Several good objectives and eye pieces; must be in first-class condition. State full particulars. Also want unmounted material. Will exchange or buy. Correspondence invited.
Chas. von Eiff, 20 Palmetto St., Brooklyn, N. Y.

WANTED—Histological and pathological material to cut on the halves. Nothing but first-class material desired.
C. B. Clapp, M. D., Danville, Ill.

RARE MOUNTS for sale or exchange; hair of Ornithorhynchus paradoxus; mummy cloth, three thousand years old; sections of bark from Charter Oak tree.
Address, Prof. H. M. Whelpley, St. Louis, Mo.

FOR EXCHANGE OR SALE—For microscopical materials or offers: A good Toepler-Holtz Electrical Machine. 12½ inch revolving plate, and current breaker, Leyden jar, Geissler tubes and numerous other accessories, the whole costing about $60. Will sell or exchange for a good microscope, and pay difference. Correspondence solicited.
F. F. Wood, Prin. Blair Graded School, Blair, Wis.

FOR SALE—A B. & L. Section Cutter, glass top, and micrometer screw, in perfect order, good as new, cost $7.50; will sell for $5.
H. F. Wegener, 1305 S. Tenth St., Denver, Col.

FOR EXCHANGE—A Browning's Student's Spectroscope, for a microscope stand, or other apparatus.
C. E. Norton, M. D., Lewiston, Me.

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All subscriptions must begin with January, and be for not less than one year.

VOL. IX. TRENTON, N. J., OCTOBER, 1889. No. 10.

NOTE ON THE TONGUE OF CHRYSOTIS ÆSTIVA.

F. TUCKERMAN.

THE following description is based upon an examination of the tongue of a single specimen of this South American parrot, probably the most common of those that reach our country.

The organ is of a dull, leaden color, is somewhat large and fleshy, expanded at the tip, and thick posteriorly. It measures 19 mm. in length, its greatest transverse width is 9.5 mm., and at its thickest part it measures 8.5 mm.

There is a manifest division into a depressed anterior and an elevated posterior portion. The anterior division is perfectly free from the floor of the mouth for 10 mm., or a trifle more than one half the length of the organ. The tongue thus possesses great freedom of movement anteriorly, as well as increased prehensile power. The elevation of the posterior division is caused by the lateral margins being folded inwards, their opposed edges being at first parallel, and separated by a well-defined, narrow, and shallow groove. In the fore half of the tongue the sides diverge rapidly, forming with the broad anterior extremity nearly an equilateral triangle.

The entire dorsal surface is quite smooth, unpapillose, and presents a finely wrinkled appearance. Posteriorly the dorsum is

marked by several fine, transverse ridges. Anteriorly, there are two sub-parallel longitudinal ridges, which, however, ultimately converge and form an apex at the tip. The extreme posterior border of the tongue (which in shape represents an isosceles triangle, the apex being forward), is fringed with rather large, soft, fleshy, conical papillæ, the points of which are directed backwards and inwards. Numerous course, retroverted, cone-shaped papillæ (averaging 1 mm. in height) are also present on the upper posterior surface of the larynx.

The under surface is smooth and unmarked by raphè or groove.

The investing membrane is blue-black in color, but loses its pigmentation and becomes almost white at the sides and tip.

TO MAKE A MICROSCOPICAL AQUARIUM FOR WINTER USE.

DR ALFRED C. STOKES.

"WHAT can be done with the microscope in the winter?" is a question not seldom asked, but seldom answered by the microscopist, except with the comprehensive word, "Everything." A detailed reply would consume a winter in the telling. A serious student can find an endless supply of microscopical objects. The single plant that stands in the sunny window would afford enough material for months of charming investigation. Even the structure of a single leaf would supply work for many an hour, and a subject for an important essay. There are appendages to certain leaves that ought to be investigated by those who have access to the plants, and some botanical statements corrected or confirmed. In reference to the leaves of the "Ice Plant" (*Mesembryanthemum crystallinum*), Alphonso Wood, in his Descriptive Botany (Flora Atlantica), says: "Air bubbles beneath the epidermis appear like dew or frost." But are they air bubbles?

The Rev. J. C. Wood, in his "Common Objects of the Microscope," refers to the great abundance of material at all times:

"No one who possesses even a pocket-microscope of the most limited powers can fail to find amusement and instruction even though he was in the midst of the Sahara itself. There is this great advantage in the microscope, that no one need feel in want

of objects as long as he possesses his instrument and a sufficiency of light.

"Many persons who are gifted with a thorough appreciation of Nature in all her vivid forms are debarred by the peculiarity of their position from following out the impulses of their being, and are equally unable to range the sea-shore in search of marine creatures, or to traverse the fields and woods in the course of their investigations into the manifold forms of life and beauty which teem in every nook and corner of the country. Some are confined to their chambers by bodily ailments, some are forced to reside within the very heart of some great city, without opportunities of breathing the fresh country air more than a few times in the course of a year; and yet there is not one who may not find an endless series of common objects for his microscope within the limits of the tiniest city chamber. So richly does Nature teem with beauty and living marvels, that even within the closest dungeon-walls a never-failing treasury of science may be found by any one who knows how and where to seek for it."

But in addition to the things of the land, the water supplies an endless variety, and even the winter need not chill the microscopist's ardor. He may make himself a microscopical aquarium. Even the slight labor of preparing and stocking it will be pleasurable, and it may easily be kept in good condition. The Infusoria and other animalcules, or "little animals," will prove agreeable companions for the long winter evenings.

But where may these Infusoria and other animalcules be found, how may they be captured and how shall they be studied? Does their capture demand extensive and expensive apparatus, and can they be examined only by complicated microscopes and first class objectives? No, is the answer to all these questions. They demand only a little persistent effort, a little patient application, an exceedingly small amount of the simplest appliances, and a good but not necessarily costly microscopical outfit.

To gather them nothing is needed but a wide mouthed bottle, a stick and a small tin dipper with a hollow handle. When the stick is thrust into the handle the collecting implement is complete. Many contrivances for this purpose are offered by the dealers in microscopical supplies. The majority of them consist of a large bottle into which is fitted two funnels, one being inverted in the jar and having a sieve or strainer over its mouth

through which the water passes after it has been poured into the unobstructed outer funnel, the claim being that the microscopic animals are retained in the bottle in ever increasing numbers. These are good in theory but not so successful in practice. If the strainer is fine enough to retain the minute creatures, the water passes slowly or not at all; if coarse enough to allow free passage to the water, the meshes must be so large that only the larger microscopic animals will be retained. And with most of them the strainer becomes so clogged by dirt that it is practically water tight, the water poured in simply rushing over the sides of the outer funnel without entering the vessel.

Another method is to drill near the bottom of the bottle, a series of holes over which a strip of fine muslin is tightly applied so as to act as a strainer. This has the same objectionable features as the more elaborate contrivances of the dealers. The wet muslin allows the water to trickle through it with vexatious slowness, retaining more dirt and extraneous matters than animals. I have tried all these things, and have discarded them for the simple glass fruit jar and the tin dipper.

With the dipper the bottle is filled, and allowed to stand on the table near the window for a few days, when the Infusoria will increase in a surprising manner. But the bottle's contents should be examined immediately, for although many forms that will not be in the gathering when first made, will develop there in a short time, and others will die and melt away almost as soon. The collection should therefore be examined with the microscope as soon and as often as possible, for the curious rule is that certain animal forms will abound and flourish for a while, seeming to appear quite suddenly, only to disappear almost as suddenly, giving place to others of different form, character and habits. The food supply acceptable to one kind may become exhausted, and the environment agreeable and beneficial to that form may become so changed that some are killed either by starvation or unpropitious surroundings, while there may be present an abundance of nutriment specially needed by the other kinds that so speedily succeed those that have died; indeed, the diffluent bodies of the latter may furnish the food demanded by their successors. But why it is that one class will die out to be followed by another, cannot be positively known. The fact, however, remains, and the microscopist in order not to

lose some rare and interesting creatures, should not only examine the gathering as soon as possible after making it, but at frequent intervals as it stands on his table in the miniature aquarium near his window.

A north window is the best place for the aquarium, because the light from that part of the sky is more diffused and more even in quality. Direct sun-light will surely kill the Infusoria, as well as much larger and presumably more hardy aquatic creatures. After a microscopical collecting trip, never place the bottles in the sun for any length of time. There is also another common practice that should be avoided in this connection.

A gentleman once took a large quantity of water from what appeared to be a pool rich in microscopic life. He carefully filled the bottle to the brim, forced in the cork, and the next morning brought the gathering to me. He was kind but ignorant. The bottle contained not a single living creature, but its contents were odoriferous and repulsive to the last degree. The water had been rich in animal life, but he unwittingly had killed every aquatic creature in his collection. He had smothered them. They were drowned, dead, corrupt. Because Infusoria and other animals live in the water is no reason that they should not need air. They cannot exist without air. Therefore be careful not to fill the bottle, and if it must be corked, see that ample air space is left between the surface of the water and the stopper.

A specie jar or glass fruit dish makes a good microscopical aquarium, into which the gathering may be poured and the contents left to themselves, a piece of glass being placed over the mouth to prevent evaporation, although this is not strictly necessary. Such an aquarium presents a wider surface to the air, it is so shallow that its microscopical contents may be more readily captured, and it occupies less space than the ordinary vessels offered by the dealers. I have been in the habit of selecting such jars as could be bought for from ten to fifteen cents each, several of which may be used at once for purposes of experimentation, or for the cultivation of different classes of microscopic animal and vegetable life. Such an aquarium, if kept near a north window, will thrive all winter, giving the microscopist a continuous supply of interesting living objects, not necessarily confined to Infusoria, but if he wish, embracing many groups of microscopic creatures.

But even the microscopical aquarium must be properly made if microscopic life is to be the object of research. A vessel of clear water will not amount to much. If Infusoria, or Algæ, or Rotifers, or worms, or any other kinds of life are to develop in these jars, their spores or eggs must first be there, food must be readily accessible to the voracious creatures, and their native habitat must be imitated as nearly as possible. All this can be done by transfering a small part of the pond or pool or ditch to the aquarium on the table. Do not act as I have known some collectors to act, and carefully reject all the water-soaked twigs, and pebbles, and fronds of "duck meat" (*Lemna*), and bits of aquatic plants, and pieces of decaying leaves. These things are often the most valuable in the collection. The little sticks may bear most beautiful colonies of sedentary Infusoria, for all animalcules are not free swimming; they often lead a roaming life while young only to settle down in some pleasant place when they have arrived at hours of discretion, remaining in that spot permanently, or until the microscopist dislodges them, or some aquatic animal swallows them, or until they accomplish their life-work and die. A pebble may be a nugget of microscopical richness. Aquatic plants, especially those like *Myriophyllum* or *Ceratophyllum*, whose leaves Nature has cut into numerous almost thread-like divisions, are capital places to search for those animals which live in colonial clusters attached to submerged objects; and the rootlets of duck-meat, *Lemna* as it is called, are almost as sure to be well supplied with these colonial or communistic groups. The decaying leaves are always either abounding in Infusorial or other microscopical organisms, or they carry the germs that shall develop, or they supply by their disintegration an abundant food supply. Take all these things for the specie jar aquarium, using judgment as to the size and quantity.

When the jars have been standing in the window for some weeks, their sides will gradually become obscured by the growth of an amorphous vegetable matter which will be exceedingly annoying to the microscopist, as it will conceal all within the vessel, and any promising bit of weed, or little swimming creature may escape capture because the dipping tube cannot be properly directed. The difficulty is easily overcome. With a small sponge tied to the end of a stick gently rub the growth from the glass, and allow it to form a part of the food supply of

the microscopic animals within the aquarium. The deposit is not entirely the evil it at first appears to be.

When the collector is gathering aquatic plants for the aquarium and for the purpose of examining their stems and leaves for the microscopic animals they may be carrying, he should not lift them from the water, since that movement often dislodges the adherent creatures, washing them away beyond recovery. A better plan is either to scoop a mass of plants into the dipper, there selecting the parts desired, throwing out those discarded, and gently pouring the water and the acceptable portions into the waiting bottle; or the wide mouthed vessel may be partly submerged and the plants gently floated into it. The former plan is perhaps the better, since any animals that may be washed from their moorings will remain in the dipper and be transfered with the water to the collecting jar.

No pond whose surface is mantled by a layer of *Lemna* should be passed without a sweep of the dipper. The little fronds and their delicate rootlets harbor many a curious creature. No slow stream where *Myriophyllum* abounds should be neglected.. Those feathery leaves are the favorite resorts of sedentary Infusoria, Rotifers and agile Entomostraca. The hornwort (*Ceratophyllum*) is likely to prove a valuable acquisition, but one that is usually less abundantly productive of microscopic supplies than *Myriophyllum*. *Utricularia* may also be examined with some probability of success, although it is usually the most disappointing of all the water plants with divided leaves, probably because it has the habit of itself feeding upon any small animals that may venture too near that valvular entrance to its utricles. *Anacharis Canadensis*, " water-weed," as it is often called, is not usually a good hunting ground for sedentary Infusoria, neither is the lower surface of the water-lily leaves. Both are always sought by the microscopist when searching for certain other forms of microscopic life, worms for instance, but they are commonly disappointing when Infusoria are the objects sought.

An old and water-soaked log, or a partly submerged and decaying plank, are hailed by the microscopist with delight, since they always prove to be treasures when Infusoria are not desired. When they are wanted the old log and the rotting plank are of but little value. It is then usually a waste of time to scrape their surfaces. If you want aquatic worms these are the places

to find them. If you want certain Polyzoa, these are the best of good places to find them; but for Infusoria go elsewhere.

A shallow pool whose bottom is covered with last year's dead leaves is commonly well supplied with free swimming animals, and some of the bottom should be scooped up in the tin dipper and taken home to the aquarium. Any pond whose surface bears much *Lemna* is also the haunt of many of the free swimming Infusoria. The most prolific places are those little ponds fed by springs at the bottom, or filled by freshets from a creek or other stream and for the rest of the year land-locked, shaded by trees and bushes, protected from too rapid evaporation by a coating of *Lemna* fronds, and filled with *Nuphar* (Candock), and *Ceratophyllum*, and perhaps *Myriophyllum*, although it is not very common in such places. The shade should not be too dense, nor the sun-shine on the surface too bright; the proper conditions can be learned only by experience and experiment. In such a pond the free swimming Infusoria will abound, or its water will prove prolific if kept in the small aquarium. These are the places too for *Chætonotus*.

Those temporary pools so often found by the side of country paths in the early spring, formed by the warm rain collected in little hollows where the leaves have lain all winter, and which dry away almost before the new leaves have sought the sun, those shallow little lakelets are often wondrously rich in forms not to be found elsewhere at any other time of the year. They should never be passed without a dip. While the surface is still filmed with ice such water may teem with animal life, just such life as the microscopist wants.

It is not possible to point out the exact locality where an abundance of microscopic animals may be found. They appear a law to themselves. The pond that may seem a likely place, may for some unknown reason be barren; while another to all appearance worthless may prove of great value. The food supply may be the cause, or the temperature, or freedom from enemies, or some other thing. The microscopist can only take his dips to the instrument, hoping he has the success he has wished for.

There is one place however to which he need never go. This is the thick mud at the bottom. Here some Rhizopodia may be collected, but Infusoria and other creatures rarely. They prefer

to wander among the leaflets of the aquatic plants, to swim in the clearer depths, or to seek their smaller prey nearer the surface. Indeed some forms of Rhizopods are only to be taken nearer the surface among the plants. Many kinds are to be found in the ooze gently separated from the bottom mud. Carrying home a bottle full of mud and water and nothing else is commonly a useless labor. Rather thrust the tin dippper among the aquatic weeds, and after several gentle turns and twists to loosen the plants and stir up the water about them, transfer the dipper full to the bottle, and hope for the best. The majority of microscopic animals may be collected in this way better than in any other. The method is not restricted to the Infusoria.

Although most of these little aquatic creatures are voracious feeders, and while some flourish in putrid animal macerations, the greater number seem to avoid filthy places. A pond contaminated by offal or the refuse of the city's garbage, will not be a good collecting ground, unless the filth is greatly diluted. Water that is offensive to the human being's sense of smell will not as a rule contain many animals. A few of a certain kind, those peculiarly and emphatically scavengers, will be there, but the collector will have a better chance for success, at least so far as species are concerned, in a sweet, clear-water pool where the weeds are profusely growing, where the trees drop their foliage in the autumn and shade the surface in the summer; where the lilies bloom, and their leaves die and by their decay supply food to the invisible animacules in the shallow depths below.

A pocket lens has been recommended as helpful in collecting creatures for the microscopical aquarium. Nothing could be more useless. With few exceptions they are all invisible to any but a comparatively high magnifying power of the compound microscope. A pocket lens will not exhibit them. A few are, under favorable circumstances, visible to the naked eye, but these are very few. The microscopist who desires the little creatures must through experience know the favorable localities in his neighborhood, he must collect them aided only by faith and a tin dipper, and until he reaches his microscope he can see them by the eye of faith alone. Here the pocket lens is a delusion.

There is an enemy to the microscopical aquarium entirely visible to the unaided vision, when full grown, and it is one that

the collector should exile from his gatherings as speedily as possible. This is the water snail and all its relatives. Carefully pick out every aquatic mollusk, and do it quickly, if you care anything about the welfare of the aquarium. Also search for those little jelly masses in which the eggs are deposited, and eject them as speedily. These hatch out in a warm room with surprising alacrity, and before the microscopist knows it the aquarium will be swarming with the unwelcome little fellows, and they will do as their parent did; they will eat by day and by night and go on forever, like Tennyson's brook. They will flourish at the expense of the plants, which in a short time will be nothing but shreds and strings and decaying particles, while the aquarium will be abundantly supplied with snail excrement. If the plants are wanted in good condition and consequently the animals, carefully eject all the water snails and their eggs. This may be done by a little daily attention for a short time, when there will be no further danger. If the eggs are allowed to remain, the young snails will soon have the upper hand, for they are too small and too easily concealed to be successfully contended with.

All the plants mentioned are useful in the microscopical aquarium, but *Myriophyllum* is the most desirable. It will thrive and help other plants as well as animals to thrive. Its finely divided leaves afford a shelter for innumerable forms of life. They are an excellent place to seek for Diatoms and various Algæ; indeed among them are to be found representatives of the fresh water microscopic creatures, both vegetable and animal. *Ceratophyllum* comes next so far as desirability is concerned, and after it there is little choice among the larger aquatic plants.

When caught, how are the creatures to be studied? A famous artist was once asked how he mixed his brilliant colors. "With brains, sir," he said; "with brains." Microscopic creatures are to be studied in the same way.

There are many complex devices afforded to facilitate this object, all of which may be commendable for their special purposes, but the simpler the device the better are the results, as a rule, and the more easily managed they are the more satisfactory. Many are to be found in the books, but the three little contrivances which I described in THE MICROSCOPE for May, 1887, are all that I have in use for every kind of microscopic life, and I have found them all that are needed.

Those Infusoria and Rotifers which attach themselves singly or in social groups to the rootlets and leaves of aquatic plants, must be examined while in the position they have selected. To do this the leaf of *Myriophyllum* or a rootlet of *Lemna* is cut off, and gently transferred to the slide, with a little water. Carefully go over every part, especially the angles and the secluded corners, for it is there that the little creatures love to conceal themselves. It is usually well to look for them with a low power objective, if the glass is a good one, and the observer's eye is trained to the work.

To transfer the free swimming forms to the slide a dipping tube is necessary. This useful appliance is described in elementary books on the use of the microscope, and known to the reader. And here again faith comes into play. The tube may at the first attempt be full of curious creatures, or it may have picked up nothing but dirt. The result can be known only when the drop is examined under the microscope. But to make and keep the microscopical aquarium is entirely within every one's control.

NOTES ON THE MICROSCOPE STAND, AND SOME OF ITS ACCESSORIES.

AN AMATEUR.

II.

THE BODY-TUBE (CONTINUED).

MANY stands of this kind have the short body lined with cloth, an arrangement that for a time insures a smooth and easy movement of the draw tube. Soon, however, especially if much used, the latter will begin to move less smoothly, until finally it will demand considerable muscular effort and both hands. The difficulty is caused by the roughening of the cloth lining, which must be remedied before the tube can again be moved easily. To do this, take out the draw tube and heat it until it is so hot that it cannot be held without some discomfort, and gently force it into the body where it must remain until cold. This in effect irons the lining, which the experimentor must be careful not to burn. If one ironing is not sufficient the heating may be repeated.

At the present day the objectives of any optician may be used on the stand of any maker, yet this convenient arrangement is only a comparatively few years old. Before the screw on the

upper end of the objective and the one on the lower end of the body tube were made of the same size, every optician had a screw of his own so that there were almost as many sizes as there were manufacturing opticians. When an objective of one maker was to be used on the stand of another an adapter was necessary, one end of which must fit the screw on the body, the other that on the objective; and as many adapters were demanded as the microscopist had objectives. Such a state of affairs must have been exceedingly inconvenient and annoying. The welcome change was due to the action of the Royal Microscopical Society, which suggested that a certain sized screw be adopted by all manufacturers, which was finally done, and now the objectives of any reputable optician will fit the body screw of any stand.

The inside diameter of the opening in the lower end of the body and the outside of the screw end of the objective, is about three-fourths of an inch. This is the Society screw, so called because first suggested by the Royal Microscopical Society of London. For most objectives as commonly made, it is amply sufficient, but for a few exceptional ones it has been found too small to allow them to exhibit all their good qualities. A few opticians make a few objectives whose angle of aperture is so great, and the diameter of their component lenses so large, that a special screw is demanded on the end of the body. This, at the suggestion of Dr. W. W. Butterfield of Indianapolis, is made about one and one-fourth inches in diameter. It is called after the inventor's name the Butterfield screw, and is to be found on first class American stands, which have almost every microscopical convenience, being placed above the Society screw so that, to use it, a part of the lower end of the body must be removed. It is not on the cheaper stands, and is not needed. Indeed it is not often needed anywhere. It is mentioned here only that the reader may know what the Butterfield screw is when he meets with the name in the microscopical literature of the day. The Society screw is an indispensable adjunct of every body tube, and is found on all American and English stands, however small and cheap they may be. And when the reader goes to the optician to select a stand, he will find it to his advantage to recollect the size of the Society screw and its position.

In this connection there is one rule to be remembered, and it

is without exception. It is that any body tube with a screw on its lower end of a diameter less than three-fourths of an inch should be rejected without a moment's hesitation. And conversely, any objective with a screw on its upper end of a diameter less than three-fourths of an inch should be rejected even more speedily. Any stand or any objective without the Society screw may safely be set down as a good thing to be avoided, and the reader may also justly view with suspicion any objective which must have an adapter to fit it to the Society screw of the stand. All of our American opticians are good and true men, but their wares are for sale, and they have a right to live up to the principle of *caveat emptor* in their business dealings. These gentlemen have "French Triplets" for sale, and any ignorant beginner will be allowed to buy them if he wants them. But I would advise him not to want them. These abominations in the way of objectives are, as expressed by a bit of unrefined yet expressive English slang, "cheap but nasty." And every one of them has a screw smaller in diameter than the Society screw, and every stand prepared to receive them has the same defect.

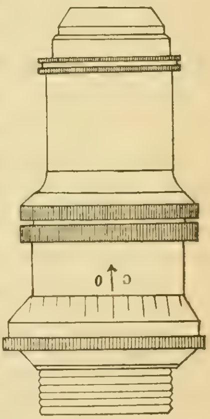

Fig. 1.

In figure 1 is shown, about natural size, a first class adjustable objective. It is represented as standing on its screw end, as all objectives should be placed when not on the instrument or in the brass cylindrical box which always accompanies them. This lower end, as it seems to be in the figure, really the upper end as it is applied to the stand, bears the Society screw. The narrow oblique portion graduated to degrees by the short straight lines engraved upon it, is the movable adjustment collar which is rotated by turning the milled ring next above it, and separated from it by the short cylindrical portion of the brass mounting. The uppermost end of the succeeding cylindrical part bears the glass lenses composing the optical portion of the objective, the entire brass tube being the mounting and intended to carry and protect the

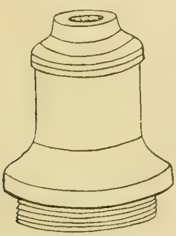

Fig. 2.

lens, and supply a means for its manipulation. Figure 2 is a low power, non-adjustable objective. Every maker has his own special pattern for the brass mounting of his objectives, but all objectives of all opticians have the same general form, differing only in detail and in size, the screw end of course being the same in all, so that it may fit the screw on the lower end of the body tube.

In figure 3 is shown, about natural size, the lower end only of the body and arm from the cheap stand with a French Triplet lens in position. Here the reader may easily observe the difference in the appearance of the French Triplets and of the good objectives, figures 1 and 2. In figure 3 notice how the lower end of the body suddenly narrows into a conical form, in order to receive the narrow screw of the French lenses. In praiseworthy stands there is no such appearance. In them the end of the body is terminated by an opening three-fourths of an inch in diameter. Notice also that the screw thread of the body is on the outside, while that of the lens is on the inside, whereas on commendable and useful stands, and on good objectives the reverse is the arrangement, the screw thread being on the outside of the objective, and on the inside of the body tube. The intending purchaser of a microscope will do well to reject any stand and all objectives with screws as just described and as shown in figure 3, as such lenses are the objectionable French Triplets and stands specially prepared for them, the whole being in the language again of our English friends, "cheap but nasty."

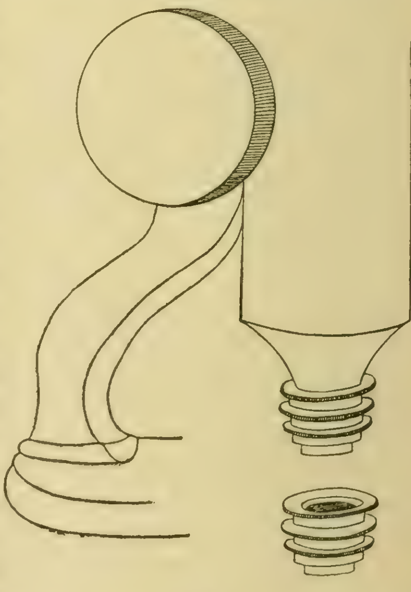

Fig. 3.

French Triplets are intended to be used in two ways, either with the three parts united, a combination which is bad enough

in its optical results, or with those parts separated for lower powers, the lenses unscrewing from each other, when the results are, if possible, even more abominable. When the triple combination is separated into its three parts, each brass mounting is just one-half inch in diameter, while the glass lens measures one-fifth inch across, and the aperture of the screw one-fourth inch. The special instrument from whose French Triplet these measurements were made, had its screw about one-fourth inch in diameter, of course, but the actual size of the round hole through which the light was admitted into the body after having passed through the objective, was one-tenth inch! Carefully reject all so-called objectives of these dimensions.

Each part of the three lenses forming the French Triplets is a thin brass disk, an opening on the upper side being encircled by the screw thread, while the lower surface bears a circular, projecting ring into which the single plano-convex lens is fastened, the ring having an external screw thread. In good objectives, even the most inferior produced by any reputable maker, corrections are made for spherical and chromatic abberation. In French Triplets, however, no attempt at correction is made except by the superposition of the two or three simple plano-convex lenses forming the combination, the one below being supposably corrected by those above. Yet at the present day, when the cheapest American objectives are infinitely superior to the most expensive French Triplets, the latter are kept in stock by the dealers, and sold when demanded.

The Triplets are the highest powers of those optical abominations. The low-powers are in another form. These are called Doublets or often "Stove-pipes." They consist of a blackened brass cylinder one-fourth inch in diameter and one-half inch or less in length, to each end of which is screwed a single plano-convex lens, the whole Stove-pipe being applied to the body tube when the abomination is to be used. Stove-pipes are no better corrected and no more desirable as objectives than the Triplets. Yet in one sense they are cheaper, while in another they are more than costly. A Doublet with one inch focus costs two dollars and one-half, and even at that price its expensiveness is phenomenal. A one-fifteenth inch Triplet, a high power, can be had for ten dollars, and is worthless for anything but a toy. As these objectives are supposed to be employed either combined

or separated, the lenses in the latter event are used singly; but since not the least attempt is made toward correction in the single lenses, the result is interesting and abominable. Still, this is another instance where too much must not be asked from the same optical appliance. If a combination objective is good when used as a combination, the chances are that it will not be so commendable when disrupted. There are good combination objectives made in America and Germany, but French Triplets do not belong in that category.

The cost of the cheapest one inch objective by American makers is five dollars, or twice that of a "Stove-pipe," or Doublet, of the same focal length, but the former is not only twice as good, but so infinitely superior that there can be no comparison between them. As for the one-fifteenth inch, the beginner would not want it at any price, nor even a better one. But the French Triplet one-fourth inch costs three dollars and fifty cents, while the least expensive American objective of the same focus is catalogued at fourteen dollars. These commendable lenses seem somewhat high priced, but they are in their way works of art, especially when compared with French Triplets. If the beginner cannot buy them, if he must have "Stove-pipes" or French Triplets or none, he will do well to take none. The image formed by these lowest of low grade French lenses is of the poorest quality. The outlines are thick and indistinct; the general aspect is dull and lifeless, and the whole field of view has a hazy appearance, as if the observer were looking through a faint mist. The outlines of the image formed by the cheapest of American objectives are comparatively sharp and distinctly marked, the field of view is clear and bright, and the whole aspect of things is brilliant and attractive. These Triplets, and Doublets, and Stove-pipes are exceedingly costly in another than a mere pecuniary sense.

The continued use of French Triplets must have an injurious effect on the microscopist's eyes. The image is so dull and the outlines are so obscure, that to see much of anything demands a strain on the eye that must, according to my experience, soon become fatiguing and finally injurious, unless the owner's eyes are exceptionally strong. The reader may have suspected by this time that I have no very favorable opinion of French Triplets or even of "Stove-pipes," but my opposition is not a mere

whim; it is the result of personal experience. I used a "Stove-pipe" and a French Triplet for several years before I learned there was anything better, and I am sure, of a fact I know, that their use did my eyes irreparable injury.

On first class American stands a useful contrivance is applied to the lower end of the body, and named the safety nose piece. It consists of a short tube sliding easily within the body, and pressed upon by a spiral spring so that when forced upward, the pressure of the spring tends to return it to its former position. Its use is to protect high power objectives and the object also. High power lenses usually have a short working distance, so that there is danger, while focussing, of touching the front of the lens against the glass slip, a thing that every careful microscopist is anxious not to do, since the thin glass cover over the object may be cracked, and the lens may be scratched or broken, a much more serious matter than the breaking of a cover glass. But should such an accidental contact occur, before injury can be done, the safety nose-piece will slide upward, at once relieving the pressure on the objective and calling the microscopist's attention to the danger. But any microscopist who will focus an objective while looking through it almost deserves to injure it.

Another interesting and often useful device on first class American stands and a few foreign ones, is the scale and vernier on the side of the body and the arm, for the measurement of the working distance of objectives. It is never found on smaller and cheaper stands, where it might well be applied without great additional cost, and be used to assist the beginner in focussing his ojectives. However, it is not there, and at best it is only a luxury which need not be further discussed.

THE DRAW-TUBE.

On the majority of stands a draw tube will be found within the body if the latter is of standard length. On those whose body is shorter than ten inches, the draw tube is used only to make the extension to the standard, and no additional one will be on the instrument. The length of the draw-tube is usually almost that of the body, so that it will lengthen the latter enormously when fully extended, and correspondingly increase the magnifying power. Its upper end commonly projects somewhat beyond that part cf the body, affording a means of manipulation, and for carrying the eye-piece.

The lower end bears a diaphragm whose aperture sometimes contains the Society screw, so that very low power objectives may be placed there and used while entirely within the body. This is often a great convenience in the employment of such objectives as the five, four, or three inch, which have such an exceedingly long working distance that occasionally the body must be raised so high above the stage that it will run off the rack before the focus is obtained, but if the objective is on the diaphragm of the draw tube it may be approximately focussed by pulling out that tube, the focussing being completed by the rack and pinion on the body. These low power objectives are at times very useful in the study of large objects, where not much amplification is desired.

What are styled Students' stands often have the draw tube diaphragm supplied with the Society screw. It is not restricted to first class instruments, as it is almost a necessity on any stand, for it not only may carry the low powers, but also the Amplifier, and the analyser of the Polariscope. As a diaphragm of some kind must always be in the tube, and as the Society screw can add but the veriest trifle to the cost of the stand, the purchaser might do well to seek an instrument with this convenience.

The draw tube is also often externally graduated to parts of an inch or of centimeters or both, so that the distance to which it is extended may be recorded and a desirable result be reproduced at any future time. The only graduation on the cheaper stands is a single circle engraved at the point to which the tube must be extended to make the body of the standard length.

When the part is to be drawn out, do so with a strong and steady pull, holding the body firmly in position at the same time, otherwise it may be run off the rack and entirely off the arm. Do not turn the draw tube from side to side while extending it. The latter method puts a severe strain on the rack and pinion, and on the fine adjustment if it is at the back of the arm. When it is to be pushed in, grasp the milled head of the pinion, or hold the body so that the latter can not move, while the tube is slowly and steadily pressed down. If these precautions are not taken, and the objective is on the body, it may be forced against the slide, or the air compressed within the body may throw out the eye-piece.

A NOTE ON DIFFLUGIA URCEOLATA.

H. M. S.

ABOUT four o'clock one afternoon the field of my microscope contained a *Difflugia urceolata*, Carter, across the mouth of whose shell I thought, at first glance, an *Amœba proteus* was passing. A higher power objective told another story. The *Amœba* was not wandering past the home of a relative, but was coming out of its own front door, and was in visible connection with the concealed portions of the owner and inmate. The shell was sufficiently transparent to show the passage to and fro of the protoplasm and its granules between the exterior *Amœba* and the partly concealed internal sarcode, and to prove that the former was but an extension of the sarcodic substance of the *Difflugia* itself. The Rhizopod appeared about to change its residence or to undergo an alteration still more momentous. The movements of the extruded mass were amœboid and active, and its resemblance to *Amœba proteus* was close, with the exception of its habit of protruding numerous, short projections which gave it a villous appearance, resembling that of *Amœba villosa*.

Twenty minutes after it was first seen, the protoplasmic current suddenly set in in one direction and poured out of the shell, dragging a posterior extremity thickly villous. It was then to all appearance a large and active *Amœba villosa*, and would certainly have been so considered had not its exit from the shell of the *Difflugia* been witnessed. It extruded no pseudopodia, but moved forward by a steady, onward flow of its protoplasm. The villous patch was always visible, and a curious fact is that by carefully watching this velvety region a change in the direction of the *Amœba's* movements could be predicted before the movement had begun. When the patch appeared on the advancing extremity the *Amœba* at once began to move in the opposite direction. It seemed as if the creature considered the velvety spot as a cluster of enemies which must be avoided.

About twenty-five minutes after it was first seen, it was almost motionless, and the whole body, for the first and only time, became densely villous. Five minutes later the ectosarc became remarkably thick and distinct, the endosarc showing very slight motion. It rested unchanged for about five minutes longer, when it resumed its course and continued to wander about the

field, quiescent at intervals, up to half past six, when I was compelled to leave it until the next morning when it was dead.

The cause of this interesting exit from its home, a voluntary exit it seemed, is a mystery to me. The shell was to all appearance uninjured, and the animal itself appeared in a healthy condition, yet there might readily have been a disease or a mortal uneasiness not apparent to a microscopist who is not practically well versed in the pathology of the Rhizopodia.

Dr. G. C. Wallich reports that he has seen the common *Amœba* explore the mouth of an old and abandoned shell of a *Difflugia*, much, I suppose, as the hermit crab will examine an apparently acceptable sea shell before leaping into it, and he states also that the *Amœba* finally approved of the domicile as a home and, entering took possession, thenceforth protruding its pseudopodia, and dragging the shell about as if it had been formed by it as the original owner. Whether the *Amœba* in the incident which I have described would ever have returned to the abandoned shell, I of course do not know. And that it was an *Amœba villosa* leaving a shell which it had examined and found wanting is a suggestion, but scarcely a plausible one. However, it was an interesting sight to the observer, and one long to be remembered.

EDITORIAL.

THOSE microscopists who live in the eastern portion of the country and are fond of studying microscopic aquatic life, have not had a successful nor an entirely pleasant season. It is true that the microscope is superior to all seasons and times, but the worker who has had the capture of the minute inhabitants of the pools and the meadow ditches at heart has not been quite happy. The rain it has rained every day, almost. The ponds have overflowed their banks and not rarely carried those banks with them. The sluggish stream has become as swiftly flowing as a mill race. Even the meadow ditches have been full to the brim, and he who has set out in search of those quiet places, and the still and shady shallows where he has been accustomed to find his treasures, has returned empty handed.

According to the reports from Washington, fifty per cent. more rain has fallen this season than ever before. And according to the statistics of the Pennsylvania Weather Bureau for the months of June and July, enough rain has fallen during those eight weeks to form a lake a thousand miles square and about thirty-five feet deep; while during the great downpour of the three days that brought disaster to Johnstown, the weight of the rain that decended on the mountain plateaus of Northern Pennsylvania is said to have amounted to nearly seven billion tons.

What chance has a Rotifer or an Infusorian in a struggle with such raging torrents as the ditches have been this season? And how could an Algæ or a Diatom keep its hold to any support when the usually quiet pond was foaming over its banks? The larger and stronger plants to which these microscopic creatures commonly cling have had few such guests this summer. The rushing waters have lashed and scoured them. It has been an uncommon sight in the locality where these lines are written, to see this season those little patches of green Algæ which are usually so abundant. The water surfaces have not been still long enough to allow them to grow. That the Rotifera, and the Infusoria, and the Entomostraca, and all other attractive denizens of the waters have been as abundant as ever, there is no doubt; but how is it possible to capture an invisible creature when a torrent is hurrying it away? The collector of pond life needs still places, and he is pleased when he finds a pool partly dried by the warm air, yet shaded by the trees, for there the little creatures are compelled to congregate, and there a few dips of the collecting bottle is sure to be rewarded with a rich store of all the worms, the larvæ, all the creeping and swimming microscopic things that give pleasure to the student of pond life.

It is to be hoped that others in another part of the country have fared better, for we of the Eastern United States have not fared well. It is not difficult to imagine that the little creatures, some of whose ancestors may have met their death on the microscope stage, martyrs to science, may have thriven as never before, as an abundance of food particles has been swept along with them. It may not have been they who have been annoyed. They have had a wider field and an enlarged experience. It is we who have been after them with bottles and dippers and grappling hooks, who have reason to regret. It would be an agree-

able change if the student of microscopic pond life might have a chance at least to fill his aquaria with something more than muddy water before the winter arrives. As Uncle Remus has remarked on another subject, "Nuff's a nuff, en too much is a plenty."

ANNOUNCEMENT.—We are requested by the publisher of THE MICROSCOPE to state that hereafter all subscriptions should begin and end with the volume (January to December), and that no subscriptions will be taken for less than one year.

PROCEEDINGS OF SOCIETIES.

THE ST. LOUIS CLUB OF MICROSCOPISTS.

THE St. Louis Club of Microscopists met at the St. Louis College of Pharmacy Tuesday evening, August 6th. J. B. Whinery made a report on the examination of powdered acacia. Out of seven samples one was found with starch. He asked for further time in order to continue the investigation. There was considerable discussion of the subject, a member calling attention to a statement that rice starch has been reported as an adulterant of powdered acacia, and that owing to the minuteness of the grains it would not be noticed with low powers.

Prof. Whelpley exhibited specimens of both white and yellow dextrin, mounted in balsam and in glycerine. He dwelt on the fact that the starch grains in dextrin are not all destroyed as many suppose, and that they can be readily detected in a powder adulterated with dextrin. However, the microscope would show it as starch and not as dextrin. Another point was that the white dextrin is made from potato starch while the yellow grade comes from corn starch. The same member had a specimen of powdered senega which had been mixed with starch. Frank Davis reported that all the senega he had examined was free from starch. He pointed out the similarity existing between powdered senega and powdered fenugrook seed.

SAN FRANCISCO MICROSCOPICAL SOCIETY.

THE San Francisco Microscopical Society resumed activity, after the midsummer lull, by holding its semi-monthly meeting on the evening of August 28th.

The library was augmented by a number of valuable works on optics and microscopy, while the cabinet was enlarged by a series of mounted slides, mounting material and miscellaneous accessories, a gift from the society's late associate, F. L. Howard. The donation was accompanied by a letter from Mrs. Howard, setting forth the wishes of the departed member. The collection will be known as The Howard Memorial.

Mr. Wickson presented a collection of Diatoms in situ, a donation from Prof. George Davidson of the United States Coast and Geodetic Survey. They come from the northern end of Lopez Island, in Washington Sound, W. T., and will form a valuable addition to the society's working material. The Diatoms were accompanied by a sample of supposed diatomaceous earth found near Santa Rosa. E. H. Griffith of Fairport, N. Y., one of the society's corresponding members, donated a beautiful series of mounted slides, illustrating the gorgeous Diamond beetle or *Eupholus Linnei.* The glittering scales covering the body of this member of the weevil family form one of the most brilliant objects that can be presented to the eye.

C. C. Riedy exhibited a large collection of mounted Diatoms from the hand of the noted specialist in that line, C. L. Peticolas. A slide prepared by that gentleman from the recently discovered Redondo Beach earth found some miles south of Santa Monica, is thought by him to be fully equal to the celebrated piece discovered at Santa Monica several years ago, and published to those interested in this branch of microscopical research by the investigations of the late Prof. William Ashburner. Another remarkable slide in the collection exhibits what is known as the Eighth-street Tunnel diatomaceous deposit of Richmond, Va., one of the finest deposits of strewn Diatoms ever found. The slides of fossil marine Diatoms from Syzrap, Russia, and Kekko, Hungary, are also notable for the variety of their forms and the skillful manner in which they have been prepared before mounting.

F. W. Dunning of Battle Creek, Mich., forwarded a box of diatomaceous earth from Lyons creek, Calvert county, Md. The same gentleman also sent a sample of diatomaceous earth broken from a piece found by a fisherman some time in June last floating in the Pacific Ocean, about two miles off the coast of Santa Monica. The latter material will be examined and compared

with the original Santa Monica Diatoms to determine whether it contains the same variety of forms.

Dr. Riehl exhibited a pure culture of *Staphylococcus pyogenes aureus;* also, a stained and mounted specimen of the same.

ZOOLOGY

NOTE ON A PECULIAR HABIT OF HYDRA.*

IN September, while examining an aquarium containing *Hydrodictyon*, *Spirogyra* and other plants, Mr. W. G. Tight observed, on the sides of the glass, a few *Hydras*, and as some would be needed for his class work in November, he placed the vessel in a window and renewed the water from time to time. He noticed they were reproducing very rapidly by budding, but a short time before the class needed them they had all disappeared. His first thought was that they had been disturbed, but upon accidentally turning over a piece of bark that was at the bottom of the vessel, he found beneath it all the animals that had but two days before been attached to the sides of the glass. Upon examination he discovered that without exception they were all reproducing by means of eggs. The large ovaries and the testes, which were producing spermatozoa with two flagella, were forming from the ectoderm in numbers as high as six on a single animal. By placing some of the *Hydras* in the light, they again began to reproduce by budding, showing that this reproductive method seems to take place in the light, while, when about to be reproduced by means of eggs the animal seeks the dark and becomes quite inactive. Yet it is possible in this case that a fall in the temperature of the room might account for the sudden change observed in the method of reproduction. The eggs, which are covered with a thick chitinous shell, fall to the bottom and pass the cold months apparently unchanged. The species under observation was *Hydra fusca*.

AT a late meeting of the London Zoological Society, Dr. H. Woodward exhibited a pearl mussel which had entombed a little crab (*Pinnotheres*) in a cyst of pearl. "Whether or not," said Dr. Woodward, "in this case the unlucky male intruded himself upon *Meleagrina* at an unfavorable period, and finding

*Bulletin Denison University, IV., I., 131.

no female *Pinnotheres*, penetrated so far beneath the mantle of the pearl mussel as to be unable to retreat, one thing is quite clear, namely that the *Meleagrina* entombed the intruder in a cyst of pearl from which the clever pearl-bottom maker alone liberated him." The *Pinnotheres* of the oyster, or " oyster crab," is a well-known crustacean; but this is probably the first known instance of one being thus entombed; the females constantly live in the shell of their host, the males being only occasional visitors.—*The Independent.*

HUMAN SPERMATOZOA.—Mr. E. M. Nelson has recently described, in the *Journal of the Quekett Club*, his observations on the human spermatozoa, the head or spore of which he states has hitherto not been correctly figured, in all the drawings that he has seen the ovoid form having been delineated but with the larger end turned toward the tail, whereas the smaller end should be in that position. The head or spore fits into a cup, the outlines of which may be seen in both front and side views. This part does not appear to have been previously observed. At the bottom of the cup is an exceedingly variable part called the calyx, between which and the tail proper is the stem, and in the latter a structure that Mr. Nelson names the joint. On the spore he has observed a flagellum which he calls the filament, its purpose being to guide the spore into the micropyle, or the aperture into the ovum. The paper is accompanied by a plate.

BOTANY.

ALGÆ PARASITIC ON THE SLOTH.—Mdme. Weber van Bosse describes Algæ comprising three new species and two new genera, found as parasitic growths on the hairs of two genera of Tardigrada. On the side exposed to the light the hairs of these sloths are completely covered, when living in their very moist atmosphere, to the extent possibly of 150,000 to 200,000 individuals on a single hair. One of the species is green, and appears to constitute a new genus. It has two kinds of reproductive organs, large ovoid macrozoospores with four cilia, and small ovoid or angular microspores, on which no cilia were detected. The mode of reproduction could not be followed. The two other parasitic Algæ are violet in color, and from a new genus named Cyanoderma.—*Journal R. M. Soc.*

EVERY one knows of the old doggerel in which we are told that

"Greater fleas have lesser fleas to bite 'em";

but few of us have any idea of the literal truth of it. Mushrooms, and the lower order of vegetation, of which they are in some respects the type, are peculiarly parasitic; but these parasites are found still to have other parasites to worry them. Mr. Worthington J. Smith, a well-known English mycologist, has recently published a paper, describing a parasite found on the common mushroom, and which proves to be a great foe to the mushroom cultivator. It attacks the hymeneal surface of the gills, having the same color, and is entirely invisible to the naked eye. Small gelatinous spots may, however, be detected by a strong pocket lens; and their presence may even render, Mr. Smith says, the common mushroom poisonous. He names the parasite *Saprolegnia mucophaga.* Another parasite, or an ally of the mushroom, *Agaricus gloiocephalus,* he describes as *Fusisporium mucophytum.* This also is the exact color of the gills; and Mr. Smith has a rap at what some "young botanists would call the protective resemblance," and the "mimicry" involved in the fact. Besides these, there is yet on the common mushroom often a parasite on the gills in the shape of a thick, white mold, and that weaves a thick, floccose web of mycelium all over them. The under surface of the mushroom, instead of the pretty brown salmon-color of its normal condition, looks like one woven mass of felt. He has not yet been able to develop the full character of this species so as to warrant him in describing and naming it—*The Independent.*

MICROSCOPY.

TO STUDY THE ROTIFERS.—Dr. C. T. Hudson, the President of the Royal Microscopical Society, remarks that for the correct observation of the Rotifera there are only two directions to be given: first, see them alive; second, for reagents use patience. Mr. J. D. Hardy, at the same meeting of the Society stated that he had found that the best way to keep the rotifers quiet for a sufficiently long time to be able to draw them, especially when they were very active creatures, was to make a strong solution of common loaf sugar, and add it drop by drop to the water

until the rapid motions of the rotifer were stopped. This did not prevent them from keeping up their ciliary action, and the liquid remained sufficiently transparent to make observation quite easy. The quantity of the syrup to be added should depend upon the size of the cell. His plan is merely to mix loaf sugar and water until a syrup is produced about as thick as treacle, and then to add this drop by drop to the water in the cell until the rotifer is fairly fixed. The syrup simply quiets the animals without killing them, and their freedom of action could be afterwards restored by the addition of more water.

For the same purpose Dr. Hudson recommends a weak solution of salicylic acid, in which the rotifers would swim and live for about six hours when they would slowly die and be preserved by the acid.

DO NOT WASTE ALCOHOL.—The alcohol used in washing sections, and many other operations, should not be thrown away, but placed in a bottle labeled "old alcohol," and used in the alcohol lamp, for washing balsam off of slides, hardening animal specimens, and numerous other purposes which will suggest themselves.—*Prof. H. M. Whelpley.*

NEW PUBLICATIONS.

THE PLEASURES OF LIFE, Part II.—By Sir John Lubbock, Bart.—The Humboldt Publishing Co , New York. Cr. 8vo., pp. 58.

Cheered by the thirteen editions through which Part I. of "The Pleasures of Life" has passed, and by the gratifying notices received from friends and critics, the author has prepared this second volume on subjects similar to those in the first, treated in a similar manner. This, like the first part, consists of many quotations linked together by comment and criticism and suggestive hints, the whole forming a kind of ethical common-place-book with the opinions of the compiler acting the part of a cord to bind together the clippings. It seems to have been prepared upon the principle of the childish game in which one sentence suggests the next until the last player in the line finds his remarks so remote from the starting point that to retrace its advance would be impossible. When the book was in the process of formation an interesting, pretty or poetical quotation appears to have suggested an idea to the compiler, this has brought up

another somewhat similar to it, and another, until the ideas have ceased or the writer has grown tired, when another quotation starts him on another moralizing journey. The book recalls to the remembrance of the reader Jacox's "Cues from all Quarters," but it is without the satisfying qualities of that charming essay. It is scarcely adapted to consecutive reading. It is more acceptable in a momentary examination, when one of the quotations or comments may cling to the memory, and be borne away as a "seed thought" that may suggest something new, inspiring or helpful.

Ambition, wealth, health, love, art, poetry, music, the beauties of nature, the troubles of life, labor and rest, religion, the hope of progress, and the destiny of man, are the headings of its thirteen chapters, from which an idea of the contents may be obtained.

"Many of us," says Sir John, "walk through the world like ghosts, as if we were in it and not of it. We have 'eyes and see not, ears and hear not.' To look is much less easy than to overlook, and to be able to see what we do see, is a great gift. Ruskin maintains that 'The greatest thing a human soul ever does in this world is to see something, and tell what it saw in a plain way.' We must look before we can expect to see. 'To the attentive eye,' says Emerson, 'each moment of the year has its own beauty; and in the same field it beholds every hour a picture that was never seen before, and shall never be seen again.'"

In the chapter on the hope of progress, the author says: "We cannot, it would seem, hope at present for any great increase of our knowledge of atoms by improvements in the microscope. With our present instruments we can perceive lines ruled on glass which are 1-90,000 of an inch apart; but owing to the properties of light itself it would appear that we cannot hope to be able to perceive objects which are much less than 1-100,000 of an inch in diameter." One hundred and twenty thousand lines to the inch have undoubtedly been resolved, and Dr. Royston-Piggott claims to have seen objects only the one one-millionth of an inch in diameter. The author's preface is dated April, 1889, and the volume is the June issue of "The Humboldt Library." It would seem as if the author were not well informed in microscopical science. Sir John Lubbock, how-

ever, is an accomplished naturalist, and the present work from his pen, if not entirely satisfactory (it is a little tiresome), is worth owning, and worth reading, for it contains many suggestive thoughts that are worth remembering.

THE GREEN BAG, A USELESS BUT ENTERTAINING MAGAZINE FOR LAWYERS.—Edited by Horace W. Fuller, 15½ Beacon street, Boston. August, 1889.

Although primarily intended for the amusement of lawyers, this magazine should be a welcome guest at any library table. It is certainly one of the brightest, sprightliest and most entertaining of all the non-scientific journals that come to THE MICROSCOPE'S book-table. Well edited, beautifully printed, finely illustrated, it should meet with a cordial reception from any intelligent reader. Among this number's portraits of prominent lawyers and teachers of the law, it is pleasant to see that of Prof. Marshall D. Ewell, who is well known to the readers of THE MICROSCOPE. *The Green Bag* deserves every success.

THE OREAD OF MT. CARROLL SEMINARY, August, 1889.

BULLETIN OF DENISON UNIVERSITY. Vol. IV., Parts I. and II.

ON THE DEVELOPMENT OF THE TASTE-ORGANS OF MAN. Frederick Tuckerman. Reprint.

NOTES ON COREMA CONRADII. J. H. Redfield. Reprint.

MC GILL UNIVERSITY ANNUAL CALENDAR, FACULTY OF MEDICINE. Fifty-seventh session, 1889–90. Montreal.

TRANSACTIONS OF THE MICHIGAN STATE MEDICAL SOCIETY. Twenty-fourth annual meeting, June 9th and 10th, 1889. 8vo., pp. 391.

FOURTH ANNUAL REPORT OF THE STATE BOARD OF HEALTH OF THE STATE OF MAINE. 1888, 8vo., pp. 336.

CORRESPONDENCE.

EDITOR THE MICROSCOPE:—

It seems to me that "An Amateur," in his article on the "Microscope Stand," in the August number, is too sweeping in his condemnation of instruments of the continental pattern, with short tubes. I am aware that Gulliver says that in the dis-

pute that took place in Lilliput between the Big Endians and the Little Endians, eleven thousand persons suffered death rather than submit to break their eggs at the small end, and that "Many hundred large volumes have been published upon this controversy." I also recall the wrath of American instrument makers last year—Big Endians—with Dr. Minot's preference for continental, short tube microscopes. I therefor hesitate about putting in a plea for short tubes.

For several years I have used a large Beck, a delightful instrument, but I have lately bought a short tube microscope of the continental type, made by Baker of London, and I foresee that for many reasons, and for many purposes, I shall prefer it to the Beck. This instrument is free from several of the objections made by "An Amateur;" it does not have the objectionable horse-shoe base, and the pillar has a joint so that the tube can be inclined, as is the case with many of the continental microscopes.

Are his optical objections well founded? Are not the objectives which are made for short tubes as well adopted to them as the long tube objectives are to long tubes? Many microscopists think there definition is superior.

The small instruments are certainly much more "handy," weigh less, take less room, and it is certainly very much easier to dissect with them, and to use them vertically, which one frequently wishes to do.

As to "An Amateur's" advice to those who intend "to do work," that they should abjure short tubes, are not the short tubes in general use in biological laboratories where a large amount of work is carried on?

But Gulliver says, "The books of the Big Endians have long been forbidden," and unless I stop now I am afraid you will forbid all communications of both long and short tubians.

Truly yours,

ANOTHER AMATEUR.

EDITOR THE MICROSCOPE:—

Accept my thanks for your kindness in sending me the proof of "Another Amateur's" letter, and let me ask for a little space in which to reply, since there may be others in "Another Amateur's" position.

The statements that I have made in regard to the short body-

tubes are so well known by accomplished opticians, whatever may be the case with those microscopists who recommend short tubes, that the leading maker of Europe actually produces two distinct series of objectives, one set being corrected for the six inch body of the continental stands, the other for the ten inch tubes of English and American models. In his catalogue Zeiss says: "In ordering please state explicitly whether the desired lens is for use with the continental (short) or with the English (long) body-tube." Yet some professional microscopists urge their pupils and all histologists to select the continental stands and of course foreign objectives. If the American pupil is as bright as I believe him to be, he will carefully reject such advice. When short tubes are used with objectives corrected for long bodies, the novice may not observe the deterioration in the image, but that deterioration will be there. This is the great objection to the short tubes. The beginner, instead of educating his eye to habits that are good, is unconsciously but none the less surely, acquiring habits that must be unlearned hereafter. Even the beginner should have the very best image that his objectives are capable of giving. To handicap himself at the start is not only needless but almost criminal. The child who is to learn English is seldom started with the Greek alphabet. So the amateur microscopist who is anxious to learn how to make an intelligent use of the instrument, should not be forced by mistaken teaching to educate his eye over poor images when better ones are as easily obtainable. In reference to the use of short body-tubes, adverse criticism would be out of place if the novice could be expected to begin his microscopical career by purchasing the best of homogeneous immersions, or first class adjustable objectives, which he could employ intelligently and properly. He will probably do nothing of the kind, but he may unhappily fall into the clutches of the French Triplet fiend, with a short-bodied microscope, a combination whose qualities are beyond the ability of the English language to characterize.

Yours truly,

AN AMATEUR.

The Rev. M. J. Berkeley, the greatest English authority on Cryptogamic botany, is dead at the age of eighty-seven years.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS who have microscopical apparatus, material or books which they wish to exchange, and such wants will be INSERTED FREE OF CHARGE. The number of insertions given will depend upon the number of exchanges received each month. Subscribers will please notify us when articles have been exchanged or sold. Dealers are referred to our advertising department.

FOR SALE CHEAP—A Bausch & Lomb Polariscope in first-class condition.
Address W. J., 32 West Noble St., Columbus, Ohio

FOR EXCHANGE—A Hailes' "Poly-Microtome" (an automatic microtome for freezing or paraffine-embeddiug), in exchange for a Kodak camera, or other good "detective." C. E Hanaman, Box 27, Troy, N. Y.

FOR SALE CHEAP—A Bausch & Lomb Universal Microscope complete, with objectives and accessories, perfectly new. Address,
Prof. C. F. Emery, Ocean Springs, Miss.

FOR EXCHANGE—A large variety of minerals and rocks, some polished; also fossils and reptiles in fluid, for mounts. Address,
Prof. J. E. Talmage, Salt Lake City, Utah.

FOR SALE—First-class duplicate objects, five for $1. You can get your objects in any class you may name, except pathological; but no time for lists. If you do not get $1 worth, money will be returned on day after slides are returned.
E C. Hoyt, 215 Howard St., Detroit, Mich.

FOR SALE—Vols. IV, V, VI, VII, of THE MICROSCOPE, bound in two volumes; fourth edition of Wyeth's "The Microscopist;" Marsh's "Section Cutting," and Phin's "How to Use the Microscope." For cash only.
H. M. Richards, 27 Ellery St, Cambridge, Mass.

FOR SALE—Bausch & Lomb Model Microscope (No. 521 of their catalogue) as good as new, having been used but a few times. There are two objectives, a 1 inch and a ¼ inch, one 2 inch eye-piece, camera lucida, etc. Everything in perfect order. Will be sold cheap. Correspondence solicited. Address,
S. G. Robbins, Sivery, Pa.

FOR SALE—A B. & L. Section Cutter, glass top, and micrometer screw, in perfect order, good as new, cost $7.50; will sell for $5.
H. F. Wegener, 1305 S. Tenth St, Denver, Col.

FOR EXCHANGE—A Browning's Student's Spectroscope, for a microscope stand or other apparatus. C. E. Norton, M. D., Lewiston, Me.

FOR SALE—Fine collection of 144 choice microscopic objects by Wheeler, Moller Watson, and others, including Webb's celebrated micro-writing, arranged Diatoms, Type-plate of Echinoidea, Podura and other tests, in box with lock and key, $40, all new. Send for list. Also, Tolles' first-class ⅙ water immersion, 180°; cost $70, price $37.50; also, Spencer's latest homo-imm. 1-10, 116°, B. A., $52.50.
Geo. H. Curtis, New Richmond, Clermont Co., Ohio.

FOR EXCHANGE OR SALE—For microscopical materials or offers: A good Toepler-Holtz Electrical Machine. 12½ inch revolving plate, and current breaker, Leyden jar, Geissler tubes and numerous other accessories, the whole costing about $60. Will sell or exchange for a good microscope, and pay difference. Correspondence solicited. F. F. Wood, Prin. Blair Graded School, Blair, Wis.

RARE MOUNTS for sale or exchange; hair of Ornithorhynchus paradoxus; mummy cloth, three thousand years old; sections of bark from Charter Oak tree.
Address, Prof. H. M. Whelpley, St. Louis, Mo.

WANTED—THE MICROSCOPE, Vols. I to IV inclusive.
W. E. Swigert, Spencer, Owen Co., Ind.

WANTED—Several good objectives and eye-pieces; must be in first-class condition. State full particulars. Also want unmounted material. Will exchange or buy. Correspondence invited. Chas. von Eiff, 20 Palmetto St., Brooklyn, N. Y.

WANTED—A copy of the "Microscopical Bulletin," Vol I, No. 5, August. 1884. for which I will send two interesting slides.
M. S. Wiard, New Britain, Conn.

WANTED—Odd volumes and numbers of microscopical periodicals and books on the microscope. Will give microscopical periodicals in return. Send list of what you have and want.
Prof. L. A. Lee, Brunswick, Me.

THE MICROSCOPE.

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All subscriptions must begin with January, and be for not less than one year.

VOL. IX. TRENTON, N. J., NOVEMBER, 1889. No. 11.

EXPERIMENTS IN YEAST: THE PHYSIOLOGY OF NUTRITION.

HENRY LESLIE OSBORN. PH. D.,

PROFESSOR OF BIOLOGY IN HAMLINE UNIVERSITY.

THE following experiments with yeast are described for a two-fold purpose: both to record the results of a series of observations made by the students in a junior Biology class, and to show a convenient method which teachers may employ to introduce students to direct biological experimentation. The method here indicated can be applied extensively and will yield interesting and valuable results.

Four classes of experiments were performed, and although time did not permit the very exhaustive pursuit of any of the lines of research entered upon, yet each was pursued far enough to yield definite and positive results. The general method used was to cultivate yeast in Pasteur's fluid for one week, to make a drawing of a field of the microscope when the yeast was first sown, and compare this with the yeast of a week's growth; the degree of complexity of the colonies, their number, and the look of the individual yeasts, were all taken as criteria by which to decide on the favorability of the conditions furnished. If necessary to develop differences in the action of the two conditions the cultures were kept for several weeks.

Convenient culture tubes, and very cheap ones, are tall homeopathic vials, which are to be stopped with cotton batting. No sterilizing is necessary, nor the precautions needed for pure culture experiments. For the purpose these would be a hindrance. The only apparatus needed is one or more balances and a few graduated flasks for making the solution, and the reagents for making Pasteur's fluid.

In preparing the liquids for the flasks, the process was constantly the same, viz:

Pasteur's with sugar	8 parts.
Fluid yeast.	1 part.
*	1 "

Fluid yeast was made by mixing evenly one-half gramme of compressed yeast with 100 c. c. of distilled water. * stands for any reagent the effect of which is to be tried. In the first three classes of experiments it was water, and in the fourth it was various matters to be described later. I shall now proceed to describe briefly the actual experiments.

FIRST SERIES.—In this series four experiments were made, viz:

1. Yeast, 1; distilled water, 9.
2. Yeast, 1; 10 per cent. solution cane sugar, 9.
3. Yeast, 1; Pasteur's solution without sugar, 9.
4. Yeast, 1; water, 1; Pasteur's fluid with sugar, 8.

These being the customary and well known experiments I will not delay to remark on the results.*

SECOND SERIES.—This consisted of three experiments to test the effect of heat and cold on yeast. Three tubes were prepared, one being set aside as a standard, while a second was set out of the window over night, and the third was boiled gently for five minutes. The third and first were at once brought together, and on the following day the second was added. The second had been frozen for twenty-four hours, the thermometer having been below zero F. all the time, and in the night at —10° F. These were allowed a week† in which to grow, and on examination one and two were found to be equally vigorous, while three had not grown any. The naked eye convinced one of the trait which the microscope confirmed, for tubes one and two were turbid

*One student, who was in advance of the others, made a series of trials to show the advantage of the presence of a minute trace in Pasteur's fluid of potassium nitrate, calcium sulphate, etc., but no positive results were reached in the time at her disposal.

†This was the date necessitated by the students' college time-schedule. In some of the experiments an examination after forty-eight hours would have been desirable.

and contained the heavy sediment of the rapidly increasing yeast. It would be desirable, if one could control the conditions, to keep tubes in several ovens held constantly at graduated temperatures from 40° to 80° to see what heat is most favorable, but this the class could not attempt.

The third series of experiments was undertaken to learn whether light and darkness affected the growth. These were only roughly true, for no attempt was made to keep the temperature condition of the two tests constant. For comparison some fresh water Alga growing abundantly in Sach's solution was kept in a tube with each of two tubes of yeast in Pasteur's fluid, and one pair kept in the diffused light of the room, the other in a dark place. In every examination the yeast in the dark was found to be thriving, while the color was gradually fading out of the Algæ placed in the dark.

The fourth series of experiments was most elaborate. The problem was to test for the amount of various poisons, the presence of which would prove fatal to yeast. Final results were not reached in every case because of the lack of time, but interesting and trustworthy results were in all cases obtained.

The substances tested were carbolic acid, corrosive sublimate, acetic acid, hydrochloric acid, sulphuric acid and alcohol. These sorts of tests can of course be indefinitely extended. In each case one part of a given strength of the poison was added to eight parts of Pasteur's fluid and one part of sugar, and the resultant fluid was of course one tenth weaker than the trial fluid. The carbolic acid set was made by taking warm, hence fluid, carbolic acid, and weakening it to the desired dilution. The saturated aqueous solution of corrosive sublimate was employed. The alcohol was absolute; the hydrochloric and sulphuric acids were the ordinary commercial articles, and the acetic acid was glacial. The results with each reagent were carefully tested and corroborated; both external, naked eye appearance of the fluid in the tubes, and microscopic examination of the colonies as luxuriant or scanty in budding, as well as the appearance of the individual yeasts, were taken in judging whether a particular fluid was one favorable to growth. The results of these experiments were as follows:

1. Carbolic acid. The presence of this substance in amounts as high as $\frac{1}{10}$ per cent. is perfectly harmless. The yeast cells are large and translucent, and in thriving colonies; and in ad-

dition an abundant filamentous growth throve upon the surface of the fluid. One per cent. of the carbolic acid did not instantly kill the yeast, many cells of which had started and put forth from one to three or four generations of buds, but the cells were small. There was no film of other fungus on the surface as in most of the weaker strengths, and the fluid was clear. The appearance made the conclusion almost necessary, that the yeast had started to grow but was overcome by the carbolic acid. This was a surprise, and shows that the reputed antiseptic power of the reagent is exaggerated.

2. The corrosive sublimate is a far more powerful antiseptic, for while yeast throve in the presence of $\frac{1}{1000}$ per cent. of it, it was greatly checked in the presence of $\frac{1}{100}$ per cent. if not entirely killed, and it was killed at once by $\frac{1}{10}$ per cent.

3. Acetic acid up to nearly one per cent. is not unfavorable, and the few tests seemed to indicate that it was actually conducive to the growth of yeast. One per cent., and ten per cent. and even twenty per cent. do not instantly kill, but all decidedly hinder growth by budding and the development of the individual cells, the latter looking shrivelled and small, instead of large and translucent. The class did not study the individual cells very particularly, but I may say that in several of the fluids which did not kill at once, the cells began to bud but did not attain the size of fine healthy cells, and the cells' contents were affected so that they were not translucent as in normal yeasts, but more as if wrinkled or shrivelled; in dead yeasts the cell wall becomes empty save for the presence of a few dancing, highly refractive droplets.

4. Hydrochloric acid of $\frac{1}{10}$ per cent. was found to retard the yeast in no degree, but one per cent., and ten per cent. were both deleterious, judging from the scanty growth and few buds as well as the shrivelled cells, but not fatal at once, possibly not in ten days.

5. In sulphuric acid of one per cent., the strongest tried, yeasts were thriving finely, better than in acetic acid of the same strength. The sulphuric acid is therefore less harmful than hydrochloric though one might imagine that the reverse would be the case.

6. Alcohol in amount up to one per cent. was innocuous, and in ten per cent. the cells were alive and budding, though the

fluid was clear and the sediment scanty. The cells were clear and large, but in twenty per cent. they were small and wrinkled within, and the sediment was more scanty. The latter percentage plainly does not kill at once, but is certainly unfavorable to the work of the yeast.

I have cited these results because they show what is a possible and very instructive, and what proved a very entertaining and enjoyable series of experiments in physiology. They are not beyond the powers of elementary students, yet they illustrate methods of research in general use. They can easily be performed by any student even if he have not a microscope, though better if he have one.

A NEW METHOD FOR FIXING SECTIONS.

W. M. GRAY, M. D.,

MICROSCOPIST TO THE ARMY MEDICAL MUSEUM, WASHINGTON, D. C.

THE following method is identical in its procedure with the "Gum Arabic Process," provided the tissue from which the sections are cut has been successfully stained in mass.

The advantage of the present method over the gum process is apparent when it becomes necessary to stain sections in aqueous solutions on the slide. The process is as follows. Dissolve one part of gold-label gelatine in one hundred parts of warm distilled water; after the gelatine has dissolved, filter and add a crystal of thymol to prevent the formation of fungi. If on standing, the gelatine coagulates, warm slightly and use the fixative in the same manner as the gum Arabic solution, or, in other words, flow a small quantity on the perfectly clean slide, place the object on the fluid, and heat gently until the sections or series of sections are flat and free from wrinkles, taking special care not to melt the paraffin surrounding the preparations. As they are perfectly flat, drain off the superabundant fluid and stand the slide on end to dry. The best results are obtained if the slide is allowed to stand over night to dry spontaneously. After the sections are dry the whole is immersed in turpentine or other solvent to remove the paraffin, then into alcohol to remove the turpentine, thence into a two per cent. solution of potassium bichromate for five minutes, which renders the gelatine fixative *insoluble*. After washing the slide in water to free the section from the bichromate (which, by the way, will not

injure the most delicate tissue, or interfere with any staining process), the section may be stained as desired. For sections stained in mass the soaking in bichromate is unnecessary, but if after mounting the stain should prove insufficient, the sections may be readily restained by removing the cover glass, soaking off the balsam with a suitable solvent, transferring to alcohol, and then rendering the fixative insoluble by soaking in bichromate before immersing in the stain.

This process is especially valuable in staining tissues for bacteria, as it admits of extremely thin sections being placed on the slide free from wrinkles, and does not blister by prolonged soaking in aqueous solutions, as frequently happens in the use of Schallibaum's clove oil collodion process, the method in general use for staining sections on the slide.

CANCER AND ITS DIAGNOSIS.

DR J. EDWARDS SMITH.

IN a late issue of a leading homeopathic medical journal I find the following statement: "Cancer has been cured by the homeopathic remedy."

Notwithstanding the fact that I am a practitioner of this school of medicine, I cannot swallow this particular "little pill," and desire to remark as follows:

It is evident that to establish a case of "cancer" cure the existence of "cancer" must be primarily proven beyond a reasonable doubt.

The word itself—"cancer"—is largely vague and uncertain in its significance. The pathologist will, however, confine his use of this popular word to neoplasms of a malignant nature only.

In a paper presented to the American Institute of Homeopathy (see Trans. for 1881), I wrote as follows:

"It is somewhat remarkable that a word sufficient in its import to strike with terror the strongest heart, should nevertheless, from a histological standpoint, resist all and singular any attempt accurately to define the same. Alluding to this situation Dr Arnott says: 'At the present time no term is used more vaguely, and yet with more caution and misgiving, both by pathologists and practical surgeons, than the term "cancer". . It is only quite lately, long since the microscope has come into general use in medicine, that the various diseases of the lun

family, grouped under the heading "consumption" have been recognized and classified . . . . Just in like manner it behooves us to recognize that we can no longer content ourselves with the assertion that a given case is one of "cancer" . . . . We must see to what special class of malignant growths the case properly belongs'."

Since the printing of this paper in 1881, my ideas as to the nature of malignant growths have suffered little if any change. I regard them as closely allied—if not positively identical—with those forms of neoplasm popularly designated as "cancer" in its malignant state, and of such new formations I recognize tumors which will return if cut out from the body, either in the same place and in the same form, or in another and perhaps distant locality and in a different form. *E. g.*, if a schirrous of the mammæ be "extirpated" by the knife of the surgeon, it may possibly return *in loco* as a schirrous or as an epithelioma of the lip, or glioma of the brain.

Having for many years devoted considerable time to microscopy, my experience with neoplasms of a suspicious nature has brought me in contact with very many suffering patients. Notwithstanding that the majority of these were treated by skillful homeopathic practitioners, I can only add that every malignant case proved fatal.

Allopathy has the same record. Witness the late case of the Emperor of Germany, as also that of the late General Grant.

Now to "establish a case of cancer,"—this can only be accomplished by the aid of the microscope, furnished with a first-class wide-angled objective, and in the hands of an expert thoroughly conversant with the nature of malignant growths as seen through "the tube."

CYCLOSIS IN VALLISNERIA SPIRALIS.

PROF. SAMUEL LOCKWOOD, PH. D.

I THINK that to the amateur at least, a hint how to observe the circulation in this favorite plant to the best advantage must be acceptable. I have never seen it better displayed than when under the excellent manipulation of Mr F. W. Devoe of the New York Microscopical Society.

Having selected a bit of a leaf, not too mature, he shaves off one side with a sharp knife, although a razor is better. It is

then put on a slide, *the shaven side up.* A drop or two of clean water, and a cover glass of medium thickness, with good illumination follows, Mr Devoe using a prism illuminator. Begin with a six-tenths inch objective, and continue to a sixth or a tenth, and a vision is got of a startling clearness. The vivid individuality of each bioplasmic molecule, and the mystic, almost solemn movement of this pellucid stream of infinities of life, form a sensational picture of which the beholder never tires.

NOTES FROM THE AMERICAN SOCIETY OF MICROSCOPISTS.

T. J. BURRILL, SECRETARY.

THE twelfth annual meeting of the American Society of Microscopists convened August 20th, 1889, in the rooms of the Natural History Society at Buffalo, New York. The place of meeting proved in every way to be an excellent one for the Society, both in regard to the city and to the local quarters occupied. The local committees, under the general chairmanship of Dr Lee H. Smith, had everything magnificently planned and executed for the accommodation and well-being of the members, and for the work in hand. No society was ever more appropriately entertained, and no local committee ever did its duty more faithfully and effectively.

The attendance of members was also encouraging and sufficient to make the meeting notable, though not the largest in the history of the Society. It was remarked that there were more past presidents in attendance than had ever before occurred. The register shows seventy-six names, but there were a few present who did not place their names on the secretary's roll. Twenty new members were elected.

The papers and discussions were always interesting and worthy, while some were of a higher order of merit as the printed volume will abundantly show. The list of titles is as follows:

Geo. E. Blackham: "On the amplifying power of objectives and oculars in the compound microscope."

S. H. and S. P. Gage: "Staining and permanent preservation of histological elements isolated by means of nitric acid and caustic potash."

Thomas Taylor: "Detection of adulteration in tea."

Geo. E. Fell: "The microscope in diagnosis." "Observations and experiments with the Brown-Séquard elixir." "A simple deposit glass." "Examination of legal documents with the microscope."

W. Drescher: "A new form of microscope, and two new accessories."

J. M. Stedman: "The anatomy of *Amphistomum fabaceum.*

T. J. Burrill: "A microscope stand."

Geo. W. Rafter: "Photomicrography with high powers."

Lucien Howe: "Microscopic growths on normal and diseased eyes."

Chevalier Q. Jackson: "Bacteria in ice."

Chas. S. Fellows: "A collecting net."

Howard N. Lyon: "Notes on the histology of *Attacus cecropia.*"

M. S. Wiard: "A busy man's amateur laboratory."

D. S. Kellicott: "A new rotiferon."

W. A. Rogers: "On a practical method of securing copies of the standard centimeter designated 'scale A'." "On a new method of determining temperature from the readings of mercurial thermometers."

Frank L. James: "The behavior and appearance of tempered (cutlery) steel under honing."

Marshall D. Ewell: "A further study of the subdivisions of the first millimeter of 'centimeter A'."

The annual address by the President, Dr Wm. J. Lewis, was upon "Forensic microscopy, or the microscope in its legal relations." This was on all sides said to deserve the applause it received.

On Thursday afternoon at the "working session," there were twenty-five tables, at each of which some exhibition of practical manipulation or of special methods occurred. The attendance and the expressions of gratification of members and visitors showed this session to be one of the most highly appreciated of the meeting. The committee having the matter in charge, as in other cases, had things excellently well prepared, leading to a very successful result.

The exhibition or soiree on Thursday, was as usual attended by a vast concourse of invited guests, but as the whole of the magnificent library building, with its wealth of rooms and space was used, no crowding took place. A very enjoyable evening was

spent, with two hundred magnified objects open for inspection at one and the same time.

Dr Lucien Howe, of Buffalo, gave an entertainment to the members at his home on Wednesday evening, and the local committee offered the Society the choice of an excursion to Niagara Falls, or an excursion upon those noble waters before they precipitated themselves down the thundering cataract. The latter was chosen, and on Friday afternoon the steamer bearing the delighted guests, with a goodly number of citizens, left the wharf at the foot of Main street and landed several hours subsequently at the Macomb, a superb resort, where a banquet was abundantly enjoyed, and where the concluding exercises of the meeting were held.

Dr Mosgrove, on account of urgent personal duties, resigned the treasurership and Mr C. C. Mellor, of Pittsburgh, Pa., was elected to fill the vacancy. Dr Geo. E. Fell, of Buffalo, was made president for the ensuing year. The time and place for the next meeting were left to the Executive Committee.

Thus was passed one of the most profitable and enjoyable meetings the Society ever held.

NOTES ON THE MICROSCOPE STAND, AND SOME OF ITS ACCESSORIES.

AN AMATEUR.

III.

THE COARSE ADJUSTMENT.

This part consists of the rack on the body tube, the pinion with its cogged wheel acting in the depressions or teeth of the rack, and the milled heads on each side by which it is manipulated. Its action is to raise or lower the body rapidly so that the objective may be approximately focussed, or be lifted above the stage when the slide is to be placed in position, so that the two may be in no danger of coming in contact, with the possible injury of one or the other.

The rack should be as long as possible, so that the body's movements shall be ample for all exigencies. A length of from four and one-half to five inches is none too great. And its motion should be, as some one has said, "as smooth as oil." A coarse adjustment mechanism that is noisy when in action, that

rattles and gnashes its teeth, or one that makes the image change its position by throwing the body out of centre, should be rejected. The only place for such a thing is a shelf in a museum of microscopical antiquities. The action should be noiseless, perfectly smooth, and the bearings so firmly in place, that the microscopist shall have no fear that a heavy objective may force the body to run downward by its weight and the absence of resistance in the coarse adjustment mechanism, an accident that has happened. This undue looseness, however, may occur after constant and prolonged service, and a remedy is usually provided by the optician, who places two screws in such a position on the arm or elsewhere, that by tightening them the pinion bearings are tightened, and the trouble is corrected for a time. Every stand, even the best, is liable to this annoyance in a greater or lesser extent.

Some of the cheaper stands have no coarse adjustment. The body is then encircled by a collar through which it moves when actuated by the hand, the focus being obtained by pulling and pushing on the tube. This is a very inconvenient and undesirable arrangement. It is awkward, since the friction is often so great that the whole stand will move out of position before the body will budge, and frequently, more frequently than not, even when the foot is heavy enough to keep the instrument firmly on the table, both hands are needed to manipulate the body. It is dangerous, too, since under the circumstances the body has the obnoxious habit of suddenly slipping further than the microscopist intends, stopping only when it crashes against the slide, where it usually grinds and crunches cover glass and objective with apparently fiendish glee. A stand without a coarse adjustment by rack and pinion is a good stand to be permanently left with the optician. No fine microscopical work can be done with an instrument whose body slides through a friction collar. That arrangement may be cheap, but it is also a torment, a nuisance, and a peril.

THE FINE ADJUSTMENT.

When the objective has been imperfectly focussed by the coarse adjustment, its position must be further changed until the image becomes clear and bright, and the outlines as distinctly and sharply defined as the lines in the best steel engraving. This is accomplished by means of the fine adjustment screw,

which, in the older stands, will be found on the lower end of the body, at the front; on some of the oldest models and a few of the newest, it will be attached to the stage, but in the most recent it is placed at the back of the arm. The mechanism through which it works, is almost as varied as the names of the makers, levers, screws, rollers and springs being used singly or in combination.

Those stands whose fine adjustment is on the nose-piece, or lower end, of the body are objectionable because, unless the workmanship is super-excellent, the parts will sooner or later work loose, and every time they are touched the body will wabble and the image will dance. And the fine adjustment screw is touched very often. During an observation, the microscopist moves the stage with one hand, and keeps the fingers of the other on the fine adjustment screw continuously, constantly altering the focus slightly, so as to judge of the structure of the object by the changes in the appearance of the different optical sections practically cut by the objective.

When applied to the stage, a part of the latter is tilted every time the screw is turned, so that the surface must necessarily be more or less oblique, and the object and the slide must be tilted out of the horizontal position, thus changing the parallelism between the front of the objective and the surface of the object, or of the cover glass. Another important point which has been urged against this method is, that when the sub-stage condenser is used it is thrown out of focus every time the stage is tilted, because the position of the object is changed by being raised or lowered, and in delicate investigations, where this piece of sub-stage apparatus is exceedingly valuable, its focus must be steadily maintained. Other microscopists contend that while the device is incorrect in theory, it is not objectionable in practice. Mr Edward Pennock, an accomplished microscopist with the firm of Messrs J. W. Queen & Co., says in reference to this form of fine adjustment, which is used on one of their "Acme" stands: "An objection is sometimes made that one side of the stage plate is moved while the other is not, thus elevating one side more than the other. We only ask those to whom this may appear an objection, to make a practical and careful test. They will find that this objection is invalid in practice as the range of motion required is very slight." The motion, however, is still

there where it should not be, as for delicate work the stage must be as steady and reliable as possible. A stand with such a fine adjustment can never be used for any other purpose than to show pretty objects for the delectation of the owner and his friends. The beginner may in time cease to be a beginner and become an investigator. He will then want a stand whose stage will not tilt up at one end, however slight that tilt may be, for when he comes to work with high powers he will find this method of applying the fine adjustment objectionable in practice as well as in theory. The method has been used over and over again by many makers in many countries, and discarded by all. That Messrs J. W. Queen & Co. should attempt to revive it at this late day is surprising. However, the beginner will do what many microscopists, the writer among them, would advise, if he should reject any stand whose fine adjustment screw has any connection with the stage. The first compound microscope that I ever owned had its fine adjustment screw at the back of the stage, acting on a piece of metal behind and beyond the arm, by its action forcing the stage upward and allowing it to return by the weight and the spring of the plate. Of that arrangement I have a lively recollection, for while the stage usually responded to the downward movement of the screw and ascended, the decent was often accomplished only by the direct pressure of the finger.

When applied to the lower front end of the body, the screw usually acts on a lever which moves the nose-piece, the pressure of a spring returning it and the nose-piece to place. This method was used for many years and is still employed to a certain extent. And while there was nothing better to be had, few complaints were heard, although every working microscopist recognized its deficiencies; but when the change was made by transferring it to the back of the arm, every microscopist at once saw and appreciated the advantages of the position and of the action.

The most serious objection to the older form, in addition to what has been previously mentioned, is that every movement of the fine adjustment screw changed the length of the body and altered the magnifying power, which was therefore never the same for two successive moments. With the lower powers this was scarcely observable, but with high powers it became almost

conspicuously assertive. And during the use of the micrometer for the measurement of microscopic objects, it was a menacing danger, since the value of the micrometer spaces was changed with every turn of the fine adjustment screw. With the mechanism in the arm, all this annoyance is done away with, since every movement of the screw moves the entire body, including the objective and the eye-piece. If properly made it has no lost motion, and no side movement. It responds immediately to a touch of the finger, moving the body directly upward or downward with no lateral play, so that the image, even under the highest powers, does not seem to change its position from side to side, a fatal defect if present. The screw is usually and preferably placed vertically at the back of the arm, within easy reach of the fingers as the microscopist's elbow rests on the table, but some makers place it under the front of the arm, at the side, or even at the back but in a horizontal position or almost at right angles to the optic axis, that imaginary line drawn through the centres of the mirror, sub-stage, stage, objective, body or eye-piece.

The mechanical devices through which the screw acts on the tube are various and ingenious, but the effect, that of moving the entire body, is the same in all. I wish the method could be claimed as an American invention, but it can not, for it has long been used in variously modified forms in England and elsewhere. It was one of the advantages of the Ross model. In this country, however, Mr Joseph Zentmayer seems to have introduced it, first adding it to his splendid "American Centennial" stand, which was shown at the Centennial Exhibition at Philadelphia in 1876, and there formed one of the great attractions for microscopists. On this magnificent instrument, which approaches perfection more nearly than any other microscope stand in the known world, although Mr W. H. Bulloch's "Congress" is not far behind it, being in some respects its superior, the fine adjustment is removed, as Mr Zentmayer says, to the more stable part of the stand, the arm, which is provided with two slides, one for the rack and pinion adjustment, and close to it another one of nearly the same length for the fine adjustment moved by a lever concealed in the bent arm, and acted upon by a screw whose margin is graduated for the measurement of thin glass covers.

Mr W. H. Bulloch's "Congress" stand, which is somewhat in-

ferior to its only rival, the "American Centennial" model in perfection of workmanship and finish, but vastly its superior in several convenient appliances of Mr Bulloch's own invention, has the fine adjustment screw in the proper place. The mechanism consists of a lever within the arm, actuated by a screw whose milled head is grooved for photography, and graduated to degrees, the lever in its turn acting on a box containing the pinion of the coarse adjustment, all of which, with the entire body, is raised by the screw and lowered by the pressure of a spiral spring above the box.

Messrs Bausch & Lomb have devised a fine adjustment which works well, and is applied to some of their stands, the lever being used on others. It consists of two parallel blades of steel fastened by one end to the back of the case, by the other to the arm which carries the rack and pinion, the whole being so arranged that the springs support the entire body, with an upward tension. The only points of contact are at the fine adjustment screw and at the ends of the springs.

The same firm apply to some of their instruments a differential screw fine adjustment. In this appliance there are two screws the threads of one of which are further apart than those of the other, yet both work on the same shaft, one unwinding as the other winds. These movements result in an advance equal to the difference between the threads, so that by making that difference very small, the progressive movement may be correspondingly decreased. This mechanical principle, when applied to the microscope, makes an admirable fine adjustment for use with high powers, since the body may be moved through a distance quite imperceptible to the naked eye, yet sufficiently affect the focus. A well-made lever movement, however, is less complex and expensive, and almost equally sensitive. The fine adjustment screw on Mr Bulloch's Congress stand, by a turn through one graduation, lifts the body one one-thousandth of an inch.

In their "Acme" stands Messrs J. W. Queen & Co. apply the fine adjustment to the back of the arm, with a system of internal rollers that has not been fully explained. The description of the stand says: "The body is firmly carried upon rollers, and is moved by a lever actuated by a screw at the back of the arm." The adjustment is exceedingly pleasant to use and commendable in its results.

In some of the earlier stands by Mr Tolles, that celebrated maker adopted a curious method of fine adjustment by a rotating ring attached to the nose-piece. The movement was very smooth and pleasant, but although I have had no extended experience with it, the constant use of the collar in that situation has always seemed to be rather awkward and inconvenient. The method was adopted by Mr Tolles alone, so far as I know, and only on some of his stands, which are now seldom in the market. In his largest and most complete instrument, he made use of the screw and lever to the nose-piece of the body.

It is scarcely necessary to advise the beginner to select a stand with the fine adjustment at the back of the arm. He can hardly fail to do so if he buys a new American instrument, as most of these are supplied with this most praiseworthy arrangement. There are English stands in the American market with the old form on the nose-piece, and in other respects these are good instruments, but the beginner will find greater convenience and greater satisfaction in the use of the American models.

The milled head of the fine adjustment screw on all first class stands, and on some of the less expensive, notably on Messrs J. W. Queen & Co.'s Acme No. 3, has the upper surface graduated for the measurement of the thin glass always covering microscopic objects when permanently mounted. This glass varies a good deal in thickness, and since its presence influences the action of the objective, it is often important to know just what that thickness is. The value of each graduated space on the wheel depends upon several contingencies, seldom being the same in any two instruments by different makers. What that rule is the dealer will tell the purchaser if asked. On my own stand the distance between two lines is equal to an elevation or depression of the body tube for the one one-thousandth of an inch.

PROTOPLASM.—Protoplasm, simple or nucleated, is the formal basis of all life. It is the clay of the potter; which, bake it and paint it as he will, remains clay, separated by artifice, and not by Nature from the commonest brick or sun-dried clod.—*Huxley*.

Wernich has shown that porous bodies which contain bacteria part with the germ even with a very moderate movement of air through them.—*Report of the Maine State Board of Health.*

EDITORIAL.

THE Editor has a friend called Teddy, who of late has often come into the editorial den with a sermon or a bicycle, announcing that too much printing ink is not good, and that when that viscous material gets into the blood the result is worse than blood poisoning, for it is always fatal. Teddy with the bicycle is welcome, for they mean a dash into the country among the purple Asters and the Golden-rod, with a little vacation beneath the reddening leaves. But when he comes with a sermon, that is another matter. The Editor has hitherto listened politely, but patience has now ceased to be a virtue, and henceforth these addresses shall be reported, and with no more credit to Teddy than he strictly deserves. Hereafter, anything especially good in this department will be from the Editor, everything else, particularly if with a didactic and dogmatic tendency will belong to Teddy, and he must take the consequences. He was in the sanctum to-day without the bicycle.

It is easy for every one to lighten his daily labor by putting into it what is called "heart," which of course means an active and intelligent interest that will surely inspire those around him to do the same. It must be work for the sake of the work, and for the sake of accomplishing something; the labor however distasteful will then seem lighter and pleasanter, and the time demanded by it will pass quickly. It is the motive that cheers the worker, and lightens the work.

> "Who sweeps a room, as for Thy laws,
> Makes that and th' action fine,"

says good old George Herbert.

There is a way too of taking advantage of every help, however small, to make the result more perfect and the labor easier. The type-writer is now as essential as the sewing machine; and before many years the microscope will be as common as the piano or the cabinet organ. Even now almost every school has one or the other of these musical instruments, and every school without exception should have a microscope.

If the teacher were wise he would not sleep another night without a microscope in his school, or without beginning to perfect himself in its use. For him it will be a benefit, for it will

suggest many a subject on which to enlighten his pupils, and he cannot tell until he dies and his work is reviewed, how much good he may have done by the exhibition of a single thing under the instrument, or a single description of a microscopic object. A pupil who is dullness and stupidity personified when the arithmetic is to the fore, may possess just that mental element needed to make him an investigator of Nature, but it may be in abeyance, waiting only the chance word to arouse it, or a chance glimpse through the magical tube to awaken it to an endless life.

The teacher has a fearful responsibility, so fearful that it ought to terrify him, unless he takes advantage of every little thing to help him in his often monotonous labor. One of these little things which is not a little thing, is the microscope. It astonishes even the most mature, when seen for the first time; to a child it is like a glance through the portals of another world. It is the door-way to another world, and the teacher who qualifies himself to do no more than to lead the pupil to that magical doorway, although he can only place it never so slightly ajar, is worth infinitely more in the world's history than the teacher who can "say his Popes," or repeat "his English kings," or give the dates of all the battles of the Ashantees.

It takes but little effort to arouse a child's interest in Nature, for all children are curious about the world around them, but where that interest will lead and where it will end, the teacher cannot tell, and need not care, for it will never lead to the bad, nor end in anything but good. And the world may profit by it.

A private letter from an eminent professor of histology in one of our most prominent universities is in touch with this idea when it says: "My interest in microscopical work began as a school boy, and I am not one of those who decry microscopy because of the tendency of some of its devotees to become lovers of pretty objects on slides, for the reason that I believe that if we could only cultivate that boyish love of the curious and the beautiful carefully enough, and then guide it aright, we could do a world of good to biological science, and save some of our young men from hours of ennui which lead to hurtful associations and habits, by having their leisure hours occupied by a profitable and healthful pursuit of information. This is one of the English ideas that I wish we could copy in this country.

How many men are to be found in England who have hobbies in geology, botany or biology, and do successful work in them, too, who are actually engaged in business during most of their time." It is the teacher who can make the beginning toward this desirable end. It is the teacher who has it in his power to do all this in this country, and more. And it would seem that the sooner he begins to prepare himself for the effort the better.

The teacher is more than the autocrat, for he can stimulate or repress as he pleases. If a single word fitly spoken can arouse an interest that shall die only when the pupil dies, the absence of that word through the indolence or thoughtlessness of the teacher may leave him forever lethargic.

A naturalist is like the poet; he is not made. But his development may be prevented. Many a child born with a love for Nature has not had sufficient will power to resist the will power of older persons, and he has been ridiculed out of his liking for "bugs and things." There are few boys, or even men, like Thomas Edwards the Scottish naturalist who persisted, notwithstanding the weight of the maternal hand, and the sting of the maternal vocabulary. In most cases it is dangerous to ridicule the boy as a "worthless bug hunter." He may be a discoverer in embryo. What a pathetic cry was that of Carlyle in his old age: "Would to God some one had taught me in my youth the names of the grasses!"

In this connection a teacher may have a weighty and an unconscious influence. It ought to be an intentional one. A single word may awaken an interest that shall never slacken. A single glance through a microscope may start into a flame the spark that might otherwise have gone out, or have been slow or late in flaming. Aside from the interest felt by all persons, the young especially, in looking at pretty things through the microscope, the teacher with even a small instrument in the school, may impart considerable that will be valuable to the pupils. Every teacher should belong to the noble army of microscopists, not only for the good he will then be anxious to do, but for the benefit and the kind treatment he will be sure to receive from other workers with the same instrument. In either event his reward will be ample.

A teacher who has no microscope in his school is not living up to his privileges. He is doing worse than that, for he is

entering the same category with that creature who actually exists and attempts to teach in a prominent school, and who is in the habit of calling his pupils "asses," and "block-heads," and "fools," and who threatens to throw them out of the third-story window, and to kick them down stairs. If I could have my way with that so-called teacher, I would kill him and give his carcass to the soap-fat man.

And with that Teddy walked out, leaving the Editor aghast.

ANNOUNCEMENT.—We are requested by the publisher of THE MICROSCOPE to state that hereafter all subscriptions should begin and end with the volume (January to December), and that no subscriptions will be taken for less than one year.

HISTOLOGY.

WHAT lies underneath the brain surface? Every where coming from the lower surface are white threads which gather into bands and pass downward and inward, and finally come out below in the form of nerves. These are the lines of communication by which messages from various parts of the body reach the brain, and along which the impulses are sent out from the brain to the body which result in speech and action. Imagine for a moment that from every part of the hand little threads pass up the arm and find their way to the brain, and there go to a special part of its surface and end. It can be seen at once that you have a little map of the hand laid out on the brain surface, projected there, to use the terms of the geographer; and in fact such a map of the entire body could readily be drawn on the brain surface if we could follow all the little threads to their ends. A sensation which has been sent in from the little finger has always gone to a definite place in your brain, and whenever a message passes along that thread and goes to your brain you feel a sensation in the little finger. The thread goes along your funny-bone at the elbow, and if you happen to strike it there you send a message along it to the brain; but as all such messages have usually come from the little finger, the brain supposes that this one has also come from there, and this is the reason that, although you strike your funny-bone, you feel it in

your finger. That is also the reason why people whose fingers have been cut off often say that they have pain in the missing finger, and when you are seated on a hard or uncomfortable chair your foot goes to sleep. Now, just as the fingers are joined to the brain we must believe that the other organs are joined to it. Thus the eye sends in its thousands of little threads to one part of the brain surface, the ear to another, the nose and tongue to another. So that each of the organs of sense is related to a special region of the brain. And each of these organs receives messages from its own particular organ and from no other.—*Prof. M. A. Starr in The Popular Science Monthly.*

Professor C. L. Herrick remarks in *The Cincinnati Lancet-Clinic* in reference to the recent investigations upon the physiology of various parts of the hemispheres of the brain, that the primary and permanent gain of experimental work has been the demonstration of the topographical distinctness of various motor and sensory areas in the cortex. The latest critical studies leave no doubt that, however difficult or impossible it may be sharply to outline such areas, there are distinct parts of the cortex occupied with special senses and special groups of muscles.

If the occipital lobe be chiefly concerned with the function of sight and its intellectual concomitants, and the origin of voluntary motions of extremities, what more natural than to expect these areas to afford quite different histological elements to the microscope?

Prof. Herrick in the midst of a series of investigations, undertaken in connection with Prof. W. G. Tight, of Denison University, upon the anatomy of the brain of rodents and lower mammals generally, has been led to believe that the attentive study of these simpler brains affords a solution of this most important problem of cerebral histology.

The subject chosen was the ground-hog, *Arctomys monax*, while the brains of rabbits, opossums, and raccoons served for comparison. The functions of the cortex were investigated by electrical stimulation and extirpation. In this way the motor centres for the fore and hind legs, the muscles of the face and neck, and the sensory areas, were accurately diagrammed. A method used for the first time, may be incidentally mentioned as worthy of more careful employment. As the electrodes were

removed from the brain a small pasteboard or wooden peg bearing a number was inserted, and the reaction produced at this point was carefully recorded upon a diagram of the surface of the hemisphere with the corresponding number attached. After the removal of the brain these tags served to check the accuracy of the diagram, and a careful drawing was made including the areas experimented on.

The brains were placed in chrom-acetic solution for twenty-four hours and then in alcohol, and continuous series of sections in various directions mounted in balsam. Several hundred such sections were prepared and studied by the method of geometric reconstruction from camera drawings and measurements.

To briefly summarize the facts elicited upon this point, it may first be stated that over the entire recognized motor area and along the limbic lobe, or region along the median fissure, a well-defined type of structure can be observed, while the remainder of the cortex contains an entirely different set of cells. In the motor area the cortex resembles that described by Bevan Lewis in the sheep and pig, though the minor subdivisions are less distinct. The outer neuroglia layer is followed by a zone of small pyramidal cells with a strong axial process derived from the superficial layer, and fine anastamosing fibrils from the lower and blunt extremity. Below this is an indistinct layer of fusiform cells, which connect below with the "giant" or ganglion cells, which are not only more than twice as large as the other members of the series, but are nested or clustered and have peculiarities of form readily distinguishing them. The axial process is strong and may be traced upward for a considerable distance. The numerous inferior processes of these giant cells connect with multipolar, parametric, or irregular cells lying upon or imbedded in the white fibre zone. Occasional anastamosing of cells of the same level can be detected, but the connection seems to be between cells of different orders.

Directing attention to the cortex in portions known to lie within the sensory area, an entirely different type of cell arrangement was found. In general, the sensory, or preferable (not to prejudice their function) centripetal, cells receive the stain less readily and are only visible in good preparations; but distinctions based on receptivity to stain are untrustworthy. The cells of the upper zone lying next the neuroglia layer are nearly

of the same size as those of the corresponding zone of motor areas, but are more nearly globular, possess a larger nucleus, and, in particular, *receive their axillary process from below.* Cells of this sort occupy the entire thickness of the cortex to the depth of the giant cells, the only variation observed being an increase of size downward. Corresponding to the giant cells of motor areas are large pyramidal cells, each with a slender downward projection terminating in an axillary process, while the *upper* blunt extremity gives off numbers of fine fibrils. Thus the contrast is complete, the course of the chains of cells being completely reversed, and the author seems warranted in assuming that there is a similar variation in the direction of the stimuli traversing these chains.

MICROSCOPY.

NEW METHOD OF STAINING BACILLUS TUBERCULI.—The *Centralblatt fur Bakteriologie und Parasitenkunde* gives the following, which it says is essentially the method of Von Kuhne, of Wiesbaden. The staining agent is crystal violet (hexamethyl violet), and the contrast stain eosin. The violet is prepared as follows:

No. 1.

Crystal-violet	1 gm.
Alcohol (95°)	30 c. c.

No. 2.

Ammonia carbonate	1 gm.
Distilled water	100 c. c.

A quantity of solution No. 2 is poured in a dish, and enough of No. 1 added that a drop of the mixture placed on filter-paper gives a deep stain. This mixture is heated to boiling, and kept at that temperature during the operation of staining. For cover-glass preparations immerse no longer than one minute. Decolorize in 10 per cent. nitric acid for four or five seconds. Wash in 95 per cent. alcohol, and counter-stain in

Eosin	1 gm.
Alcohol (60°)	100 c. c.

Stain for half a minute in cold; dry, and mount in xylol balsam.

For sections: Stain one minute; decolorize in 25 per cent. nitric acid; wash in alcohol; counter-stain in eosin, and mount as before. This method, besides being rapid, is said to produce brilliant preparations.—*National Druggist.*

DETECTION OF BLOOD STAINS.—Some puzzling murder cases have drawn much attention to the difficulties attending an accurate diagnosis of the nature and origin of blood stains. When of quite recent date, the microscope may reveal their origin, by the form, diameter, and characters of the red corpuscles. But when the stains are older, and the blood is in a state of more or less decomposition, these means will be insufficient, for the hemoglobin will have changed into hydrochlorate of hematin. These are minute, rhomboid, brownish crystals, varying in size in different animals, and requiring a power of about four hundred diameters to render them visible. If these crystals can be demonstrated, the stain is surely blood; in their absence, spectrum analysis will be required. To obtain the crystals, a fragment of the dried blood is placed on a slide, dissolved in a drop of water. A minute piece of sea-salt is added; it is covered with another thin slide, and pure acetic acid is passed between the two. It is then heated to boiling point, and acetic acid re-applied, repeating the process until the crystals are deposited. Or, a smaller quantity cf the blood may be rubbed with chloride of sodium, then boiled with glacial acetic acid; this mixture, when evaporated to dryness, will yield the crystals. Blood corpuscles are destroyed in many ways, by hot water, acetic, gallic, hydrochloric, sulphuric acids, solutions of potash or soda, chloroform, ether, and other agents. The best preservative of blood is an imitation serum, made with amniotic fluid, to which a few drops of tincture of iodine have been added. This will save both red and white corpuscles and the particles of fibroid, if the stains be wetted with it before decomposition. Alcohol, chromic and picric acids, and bichromate of potash will also preserve blood stains.—*Medical World.*

DEXTRIN AS AN EMBEDDING MATERIAL FOR THE FREEZING MICROTOME.—Mr T. L. Webb writes to the *Provincial Medical Journal* for August as follows: I find that by taking an aqueous solution of carbolic acid (about 1 in 40), and dissolving therein sufficient dextrin to make a thick syrup, a medium is obtained which is superior to the time-honored gum and sugar, in three ways: It freezes so hard as to give a firm support without being too hard; it keeps better than gum, in which several kinds of fungi are apt

to grow; it is much cheaper, costing only 4d a pound, whilst powdered gum acacia costs 5s. Dextrin dissolves but slowly in cold water, so that a gentle heat is advisable when making the mucilage.—*National Druggist.*

NEW PUBLICATIONS.

THE STORY OF THE BACTERIA AND THEIR RELATIONS TO HEALTH AND DISEASE.—By T. Mitchell Prudden, M. D. Cloth, 16mo., pp. 143. New York. G. P. Putnam's Sons.

A special gift or "talent" is needed by those who attempt to popularize an abstruse subject, otherwise they fail. Dr Prudden has that talent in an eminent degree, and his success in preparing an intelligible statement in regard to the bacteria is correspondingly successful. He writes in a pleasant style, his subject is presented in an attractive way, and his little book is as interesting as a romance, with the additional fact in its favor that while the statements are astonishing they are true.

Every reader of popular literature has some indistinct notions about bacteria and bacilli, but as to what they are, and where they come from, and what they do, the average human being has no thought, because he fears they are "scientific and deep, and beyond his capacity." To that class the author has done a favor by writing this commendable book. It is replete with just such information as any reader of the magazines and papers of the day needs to know. It will astonish and frighten him, and perhaps do him good by showing him how much danger and misery he may escape by keeping himself clean, and taking note of what he eats and drinks, and breathes. It may also help the persecuted and much swindled house-holder to learn how to make miserable in his turn the lives of the plumbers, the sewer men, and the officials of the city's water supply, all of whom by their ignorance and carelessness seem to be trying to kill him by scattering deadly bacteria through his home.

The author thinks that these invisible foes have not shared in evolutionary changes, but that they still linger in the primitive simplicity which is imagined to have belonged to the earth's earliest denizens. That Nature seems to have overlooked them adds another element of interest to these minute plants, and

that their deleterious work is usually done, not by their presence but by their poisonous excretions, detract nothing from the interest. Dr Prudden's description of the struggle between the poisonous bacteria and the white blood-cells is dramatic. When these bacteria get into the tissues they may begin to grow, producing a small amount of the poison called a ptomaine, about which poisoned point the white blood-cells gather just as they would about a wound. The arrival of these cells upon the scene signalizes the commencement of a life-and-death struggle between the bacteria and the cells. The latter attempt either to swallow and thus kill and digest the bacteria, or so closely to surround them as to cut off their oxygen and food supply, and so destroy them. The bacteria on the other hand, so long as they can grow and proliferate, produce their poison, which may kill the white blood-cells and break up the tissues round about. It is the story of the two knights in the arena, with much more important results to the waiting creature in whose body they are contending, and whose fate depends upon the strength and endurance of the microscopic combatants.

The author tells in his agreeable way what the bacteria are, many of the things that they do, and how they are studied by the experts. He describes some bacterial curiosities, among them luminous bacteria, the color-forming species, the mysterious appearance of apparently bloody drops on the Host to the terror alike of priest and layman; he pictures the strife between the yeast cells and the bacteria in wine and beer making, with other interesting and important matters. A curious fact mentioned is that among some of these minute plants there is a sort of one-sided Damon and Pythias relationship, for in the attempts to isolate certain forms by culture, it is found that occasionally two species can be grown together, but if an attempt be made to separate them, one of them will always die. The nature of this friendly tie is not known.

The chapter on the bacteria of Tuberculosis, Typhoid Fever, Asiatic Cholera, and other mortal diseases contains the latest opinions and discoveries, while those on impure food, water and ice as the sources of bacterial diseases are valuable and suggestive. The little book is unique in bacteriological literature, and can be heartily commended to the readers of THE MICROSCOPE as one in which they will not be disappointed.

SYPHILIS OF THE NERVOUS SYSTEM.—By H. C. Wood, M. D., LL. D. The Physician's Leisure Library. Detroit. Geo. S. Davis. Square 16mo., pp. 135. Price in paper 25 cents, in cloth 50 cents.

The obscurity that has long enveloped all nervous diseases is rapidly giving way to a better knowledge of the anatomy and physiology of the nervous system. The clear, logical and reasoning tone of a little brochure like this does more to dispel all the clouds than the whole libraries of such vague and verbose stuff as has been put upon us in the past by asylum superintendents and others, with the hope that it might be accepted as the standard literature of the subject.

Henry Maudsley proved himself equal to a rational consideration of insanity, doing much to free it from the half superstitious air in which it was surrounded. Dr H. C. Wood is also a logician, and his little book on nervous syphilis is delightful and valuable, in that it offers in a clear and concise way the author's well-digested opinions supported by reason. There is an individuality about every thing that Dr Wood writes. He is never ambiguous, nor does he leave any room for doubt in regard to the position he takes. He courts contradiction by his tone of assurance, and he is ready to sustain his views by argument.

"Syphilis of the Nervous System" is to be commended to the medical reader. Some of it is not entirely new, but new and old are alike in attractiveness, for their consideration and treatment are excellent.

MISCELLANEOUS.

A thing is worth precisely what it can do for you, not what you choose to pay for it.—*Ruskin.*

Ninety-nine per cent. of ambition to try, and one per cent. of talent, is all that is necessary to succeed in whatever we undertake.—*Scientific American.*

Dr Schill recommends wafers as solid media for the cultivation of chromogenous bacteria. The wafers are wet with a nutrient solution and sterilized.

ANTIQUITY OF DIATOMS.—Abbe F. Castracane believes that Diatoms belonging to species now existing lived in the Carboniferous period; and since he finds in beds belonging to the older

Carboniferous strata Diatom valves identical in the minutest particular with the existing *Epithemia gibba* and *E. granulata*, and since similar facts are recorded with regard to the Foraminifera, he concludes that the same laws of generic and specific characters prevailed, and always have prevailed, equally in the lowest and in the highest families of both the vegetable and animal kingdoms—*Journ. R. M. Society.*

A VERY BEAUTIFUL INCIDENT.—While sitting at my window, which faces east, one morning in June, viewing a slide of *Funaria hygrometrica* capsules, I experienced the following: My slide was illuminated by a white cloud, which, as the sequel will show, came directly between the sun and the object under view. After watching for some minutes, suddenly the cloud moved away from between the sun and the condenser I was using, thereby condensing the direct rays of the sunlight upon the capsule, causing the peristome, by the condensed heat, to open in all its splendor, disclosing the interior of the capsule with its beautiful golden spores. Almost as quickly a cloud came between the sun and object, when the peristome went back to its normal condition. I do not remember ever witnessing so magnificent a spectacle, which was the more striking because unexpected. My instrument was a binocular with one-inch objective.—*John A. Howe, in Science Gossip.*

ANIMAL LIFE IN THE GULF STREAM.—The surface-waters in the Gulf Stream teem with minute life of all kinds. There the young of larger animals exist, microscopic in size; and adult animals which never grow large enough to be plainly visible to the naked eye occur in immense quantities. By dragging a fine silk net behind the vessel, these minute forms are easily taken, and when placed in glass dishes millions uncounted are seen swimming backward and forward. When looked at through a microscope we see young jelly-fishes, the young of barnacles, crabs, and shrimps, besides the adult microscopic species, which are very abundant. The toothless whale finds in these his only food. Rushing through the water, with mouth wide open, by means of his whalebone strainers the minute forms are separated from the water. Swallowing those obtained after a short period of straining, he repeats the operation. The abundance of this kind of life can be judged from the fact that nearly all kinds of whales exist exclusively upon these animals, most of them

so small that they are not noticed on the surface.—*Ralph S. Tarr, in Popular Science Monthly.*

In the *Farhandlinger I Videnskabs-selskabet I Christiania* for 1887, Prof. G. O. Sars describes an interesting method of transmitting microscopic creatures, especially from great distances, with a detailed account of the success of his experiments.

On the 14th of March a quantity of mud was gathered from a fresh water lake in the northern part of Australia. This was dried and sent to Christiania, where it was received on the 29th of October, in masses so hard and stony that they were broken with difficulty. The weather was so cold that experiments were not begun until the last of May, the mud and its contents having been in a dried condition for more than a year. It was finally placed in an aquarium consisting of a large cylindrical glass vessel, where a great number of the various orders of the Entomostraca were hatched out from the " winter eggs " dormant in the gathering, and in many cases studied throughout several successive generations. Prof. Sars' method of obtaining a supply of these minute forms from a distant part of the world is a suggestive one, and in the hands of others may be followed with as successful results.

Assuming that the specific cause of diphtheria is the Klebs-Lœffler Bacillus or some other bacterium, clinical and epidemiological observations, irrespective of the help from the bacteriologists, have shown that the specific micro-organism is endowed with a persistent vitality. Infected clothing and infected rooms have many times been known to retain and communicate the infection months or years after they were infected. It is therefore entirely safe to assume that the bacillus of diphtheria, dried and wafted abroad in the open air, free, or clinging to filamentous particles, may retain its viability for some time. These germs may be carried a long distance by the wind, but all the particulate contents of the atmosphere, of course, have a tendency by virtue of their high specific gravity, as compared with that of air, to fall to the ground again. When in process of ventilating infected rooms, the infection-laden air is poured out, it is so immensely diluted in the great ocean of external air that, practically, we may consider its harm-producing abilities as annihilated; yet it is conceivable that a stray bacillus among the millions may, in the subsequent process of aerial sedimentation, find a human

being and even a susceptible one.—*Report of the Maine State Board of Health*, 1888.

Prof. Cohn, of Breslau, one of the best authorities on bacteria, has recently called attention to the remarkable work of Leeuwenhoek done in this same department of research more than two centuries ago, before the compound microscope came into use. This pioneer microscopist observed in the cleanings of his teeth several kinds of organisms which are now known to belong to the Schizophytes, and described them so accurately that they are easily recognized. One he said "resembled a rod" (Bacillus); others had the habit of "bending in curves" (bacteria); others of "creeping in a snake-like fashion;" and another kind, "extremely minute, resembled a swarm of flies rolled up in a ball" (Micrococcus). When it is remembered that this group of plants includes the most minute of all organisms, it is a matter of astonishment that this old naturalist should have been able to see so much with such imperfect instruments as were at his command. His microscopes were beads of glass of various sizes which he made himself. It affords another illustration of the fact that genius consists in the power of doing much with little.

It is well known, as stated by Darwin, that fresh-water mussels and other animals may by adhering to the feet of aquatic birds, such as ducks and wading birds, be transferred from one stream or pond to others. Thus may be partly, at least, explained the similarity of the fauna in widely separated inland basins. But except the isolated observations of Darwin and a few others, little has been done to find out definitely what animals might be thus distributed. M. Jules de Guerne has lately made a careful examination of the organisms found in the particles of slime adhering to the feathers, bills and feet of wild ducks (*Anas boschas*) The webbed feet were washed with especial care, and a microscopic examination of the water revealed the presence of little nematode worms, Rotifers (*Philodinidæ*), Rhizopods (*Trinema enchelys*), Diatoms, Desmids, numerous, encysted organisms, isolated eggs of cladocerous crustacea, pieces of polyzoon statoblasts (*Plumatella*), and the shell of an astracod (*Cytheridea torosa*). Spores and cysts were also found in slime particles taken from the feathers.

DISSEMINATION OF BACILLUS BY FLIES.—MM. Spillmann and

Haushalter have been experimenting with flies to show they may be the carriers of the Bacillus of Tuberculosis.* They captured some flies from the vessels containing the expectorations of patients suffering from Tuberculosis. These flies soon died, and examination showed the presence of abundant Bacilli of Tuberculosis both in their excrement and in their abdominal cavities. Since the flies die and crumble to dust in odd corners, the Bacilli may readily be liberated, and the germs may also be landed along with the excrement on articles of food and clothing. While it is not yet known how the life within the fly may affect the vitality of the Bacilli, it seems at least advisable that the precaution should be taken of covering and of sterilizing the expectorations of Tuberculosis.

The *Med. Times* quotes from the address of Dr Sternberg, which was delivered at the College of Physicians, a large number of degrees of heat at which certain pathogenic organisms die. This address of Dr Sternberg's reflects great credit on its author, being the first of its kind in this country, and carried to such a great extent. Among the various organisms and degrees of heat required to kill them we note some of the more important:

Typhoid Bacillus	132.8°
Cholera Bacillus of Koch	125.6°
Anthrax Bacillus	129.2°
Tubercle Bacillus	212. °
Pneumococcus	136.4°
Staphylococcus p. aureus	136.4°
Streptococcus of erysipelas	129.2°
Micrococcus Pasteurii	140. °

*Journal of R. M. S. from Comptes Rendus.

At the late German Medical Congress at Wiesbaden, Dr Hanau, of Zurich, showed microscopic and macroscopic specimens illustrating his success in inoculating cancer from one rat to another.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS who have microscopical apparatus, material or books which they wish to exchange, and such wants will be INSERTED FREE OF CHARGE The number of insertions given will depend upon the number of exchanges received each month. Subscribers will please notify us when articles have been exchanged or sold. Dealers are referred to our advertising department.

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H. F. Wegener, 1305 S. Tenth St, Denver, Col.

FOR EXCHANGE—A Browning's Student's Spectroscope, for a microscope stand or other apparatus. C. E. Norton, M. D., Lewiston, Me.

FOR SALE—Fine collection of 144 choice microscopic objects by Wheeler, Moller Watson, and others, including Webb's celebrated micro-writing, arranged Diatoms, Type-plate of Echinoidea, Podura and other tests, in box with lock and key, $40, all new. Send for list. Also, Tolles' first-class ⅙ water immersion, 180°; cost $70, price $37.50; also, Spencer's latest homo-imm. 1-10, 116°, B. A., $52.50.
Geo. H. Curtis, New Richmond, Clermont Co., Ohio.

RARE MOUNTS for sale or exchange; hair of Ornithorhynchus paradoxus; mummy cloth, three thousand years old; sections of bark from Charter Oak tree.
Address, Prof. H. M. Whelpley, St. Louis, Mo.

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W. E. Swigert, Spencer, Owen Co., Ind.

WANTED—Several good objectives and eye-pieces; must be in first-class condition. State full particulars. Also want unmounted material. Will exchange or buy. Correspondence invited. Chas. von Eiff, 20 Palmetto St., Brooklyn, N. Y.

WANTED—A copy of the "Microscopical Bulletin," Vol I, No. 5, August. 1884. for which I will send two interesting slides.
M. S. Wiard, New Britain, Conn.

WANTED—Odd volumes and numbers of microscopical periodicals and books on the microscope. Will give microscopical periodicals in return. Send list of what you have and want.
Prof. L. A. Lee, Brunswick, Me.

TO EXCHANGE.—Zeiss-Abbe condenser complete, 2 in. bull's eye condenser, Excelsior dissecting microscope, Schrauer's Improved Sterling microtome, solid ½ in. eye piece, all new, for good American sub-stage condenser, machine microtome, Polarizer, or objectives. W. N. Sherman, Kingman, Arizona.

WANTED.—Good pathological material; will cut on shares, or give slides in exchange. E. D. Bondurant, M. D., Tuskaloosa, Ala.

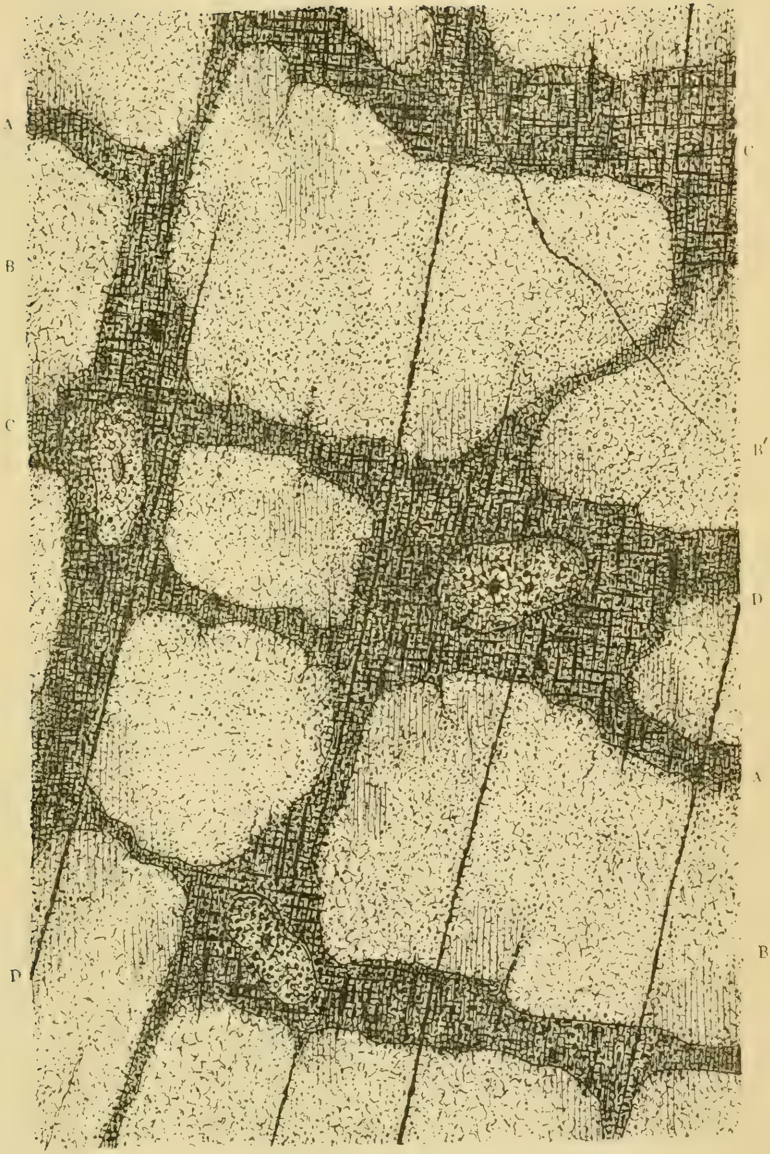

PLATE XII.

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THE MINUTE STRUCTURE OF THE CORNEA.

I.

THE SO-CALLED CELLS OF THE CORNEA.

C. HEITZMAN, M. D.

WITH PLATE XII.

IN order to obtain specimens suitable for the study of the minutest anatomical features of the cornea, one must sacrifice a cat, immaterial of what age. I do not think the harm done either to the useful domestic feline, or to the individual victimized, is very great. A cat, though possessed of nine lives, is killed rapidly and painlessly in either of two ways: by strangulation or by chloroform. If we resort to the former rather inexpensive procedure, we have to take a strong, long rope, one end of which is fastened to the knob of the door, its middle being transformed into a loop, applied around the neck of the cat and the other end held in the hand. It is important to take a long rope, since the cat, as any other creature, is not willing to enter Hades without a struggle, and might, with her claws, do severe injury to the scientist, if within reach of his body. The second and nicest, though somewhat expensive way to kill a cat is to place her under a large bell-glass and to put under the same a cup holding a sponge saturated with chloroform. At first the

cat appears to be surprised at the peculiar smell of the chloroform, much the same as is a human being who is compelled to inhale it for the first time. The animal makes attempts to escape, but her efforts are rendered futile by the smoothness of the glass. Soon she will become unconscious, will tumble to the floor and die in a few minutes without a struggle, if a sufficient quantity of choloform be used.

With a pair of scissors the cornea is rapidly cut out, not too near the body of the sclerotic, placed in a dilute solution of lactic acid of about ten per cent. strength and left in this solution for about twelve hours. After the lapse of this time the cornea is transferred into a saucer filled with a solution of chloride of gold, not stronger than half of one per cent. and slightly acidulated by the addition of a few drops of lactic acid. While the specimen is exposed to the chloride of gold, the light should be shut off from it by a towel spread over the cover of the saucer. After two hours' exposure to the reagent, the cornea is transferred into a flat plate filled with distilled water, and by means of two delicate forceps is split up into the thinnest possible lamellæ, about forty of which will be furnished by each cornea. The lamellæ thus obtained are mounted in chemically pure glycerine, preferably that of Merck which, though costly, serves our purposes best. The thinnest cover glass should be used. In a day or two, after which time the specimen remains exposed to broad daylight on a sheet of white paper, and after thorough cleansing around the borders of the cover glass with folded up Swedish paper, the sealing may be accomplished by means of asphalt or any other varnish. The specimen, in the meantime, will have assumed a pale violet tint along the border that has been directly under the influence of the lactic acid. This border is unfit for research, since its features are destroyed by the acid. The central portions will show a dark violet hue, if the light passes through it, and a golden film by reflected light.

I must justify every step I have advised. I have given preference to the cat's cornea, because we know that this is one of the best subjects for our purpose, although the cornea of a rabbit, a rat, or a frog is equally good and equally cheap. The study of all these animals' corneæ, including that of man, shows identity in all minute features. Even the cornea of a fish will furnish, in its central portions, identical results.

I have recommended the lactic acid to precede the stain with the chloride of gold, since this reagent serves best for dissolving certain chemical constituents at the border of the cornea, thus enabling us to split it into the very thinnest slabs without the least difficulty. Many experiments made for this object with other reagents, the action going on for months, proved to be failures; whereas, with the acid which does not in the least change the structural minutiæ of the cornea in its central portions not directly exposed to the acid, every single attempt at obtaining perfect specimens has been a success.

I have advised the stain with a half of one per cent. solution of chloride of gold for two reasons. In the first place, since the introduction of this reagent by Cohnheim, in 1864, all microscopists agree to its value for dyeing protoplasmic formations or cells without destroying their anatomical relations. In the second place, I have shown, in 1872, that chloride of gold renders especially plain certain parts of the protoplasm or the cells, which I recognized as the living or contractile matter proper. Thus, by resorting to chloride of gold, we gain in two respects, both as regards the distinctness of protoplasmic formations generally and the prominence of certain features within the protoplasm as well as the basis substance, showing the situation and distribution of the living or contractile matter.

Let us place a slide, mounted according to my directions, under the microscope, first with a low power, not exceeding two hundred diameters. We see throughout the whole lamella dark violet, branching, so-called stellate bodies, representing, as all microscopists admit, the "cornea-cells." In the slab under the microscope, be it ever so large, we shall never find any other but branching and interconnecting, dark violet cornea-cells, even though we may carefully study all the forty lamellæ obtained from a single cornea. In vain will we look in the healthy cornea for an isolated lump, lacking connections with its neighbors and entitled to the name of a "migratory cell," at least this is my experience after having studied hundreds of cornea specimens, treated in manifold ways. The uppermost layer, containing the stratified epithelium, is worthless for us, since it is studded with granules of the metalic salt; so is the lowest layer. For the whole breadth of the substance of the cornea, respectively, all its lamellæ that are perfectly free from granular precipitions of

the chloride of gold, my assertion will hold good. I emphasize that we see none other but branching and interconnecting "cells," their offshoots being of two kinds; some broad, others narrow and thread-like. The light fields of a pale violet tint and finely granular, correspond, as is generally admitted, to the so-called intercellular or basis substance.

Now we apply a magnifying power of five hundred diameters. Again we recognize the dark violet, branching cornea cells producing a comparatively coarse reticulum throughout the lamella. One feature, however, has now become conspicuous, viz., that the "cornea cells" are not sharply bordered toward the surrounding basis-substance, neither are the broad offshoots emanating from them in varying numbers. Furthermore, we see a dark violet, almost rectangular network within the cornea cells as well as their broad offshoots. The nucleus in the centre of each cell, or rather at the broadest points of intersection of the coarse reticulum are, as a rule, paler in color and not very prominent. The fine filaments, likewise interconnecting the cornea cells, as stated above, now appear rosary-like, beaded, made up of irregularly alternating granules and threads. The intercellular substance appears distinctly granular, though not uniformly so, as some of the finest beaded threads will be seen penetrating here and there the basis-substance, as fine but short offshoots would penetrate the basis-substance from the borders of the dark violet corpuscles.

Select the thinnest lamella at your disposal, holding not more than one or, at the utmost, two layers of "cornea cells," and place it under an immersion lens magnifying about one thousand diameters. Any one in possession of an immersion lens of the late Mr Tolles, of Boston, may confidently use it, since these lenses, in my conviction, are superior to all made either in America or Europe. It will make no difference whether your lens is made for distilled water or for cedar oil. The homogeneous lenses of Zeiss, so much in vogue now-a-days for bacteriological investigations, will answer our purpose, provided we remove the Abbe condenser, this being almost indispensable for the study of bacteria, but worthless for histological research, as the abundance of light thus obtained, renders the minute features of tissues invisible.

A new world is before us. What we see, is faithfully represented

in my drawing (Plate XII). Nobody ought to expect to see what I have illustrated, unless he be an expert in studying with an immersion lens, and this means a good deal. Every tyro, who peeps into the microscope every once in a while, considers himself an expert, entitled to add his mite to histology or microscopy. He is much mistaken, indeed. It takes not months, but years of daily, hard study with good immersion lenses, before one's eye is educated for microscopical vision. I confidently maintain that nobody will ever become an expert in this line of investigation, unless he be a draughtsman and be able to project on paper what he sees under the microscope, without the aid of prisms and other toys.

The cornea corpuscles or, if you choose, "cornea cells," are now gorgeous dark blue formations altogether made up of an extremely delicate reticulum of a prevailingly rectangular course, in connection with the central, rather indistinct nuclei, the structure of which is likewise reticular, though of a coarser type than that of the surrounding protoplasm. The reticulum is not uniform in its distribution. In some places it is so dense as to be almost unresolvable by the lens; in others somewhat looser and more easily recognizable. No boundary lines are present between the corpuscles or their broad offshoots and the adjacent basis-substance, since innumerable dark violet, delicate, mostly conical offshoots penetrate the basis-substance itself from the borders of the former. The latter now appears to be reticular instead of granular, as with lower powers. The reticulum is much more delicate than in the protoplasmic bodies, the points of intersection in these being rather clumsy as compared with the minute nodules and threads pervading the basis-substance. It is obvious that only to the extreme delicacy of the reticulum in the basis-substance is due its pale violet color, in contradistinction to the dark violet formations in the cornea corpuscles.

Let us concentrate our attention on the almost black, beaded threads before alluded to. Most of them, though somewhat varying in bulk, run a nearly parallel or rectangular course. They either traverse the dark violet corpuscles, running clear through them and through the basis-substance in order lastly to perish within a cornea corpuscle by inosculation with the dark violet reticulum held therein. Such threads approach often enough the nucleus of the cornea corpuscle and apparently blend

with the reticulum of the nucleus, without ever being distinctly traceable into its centre, respectively, the nucleoli. Some of the threads, *i. e.* the most delicate ones, run into the basis-substance and here inosculate with its delicate reticulum which, in this situation, often is found a trifle coarser than in the rest of the basis-substance. The beaded or rosary-like structure of the thread is retained to the last, viz., to the point of insertion into the reticulum.

Thus far I have contented myself with the description of facts plain and pure but not easily recognizable by eyes insufficiently trained in the art of seeing with the microscope, I admit. I now proceed to reasoning, such as must force itself upon the mind of every unbiased observer. The facts laid down are not amenable to criticism; my reasonings and conclusions undoubtedly are.

"The tissues are made up of cells and intercellular substance." Such is the teaching of the cell theory. What is a cell? Nobody knows. A lump of protoplasm, the most advanced histologists claim, and representing an isolated individual endowed with properties of life.

If we watch the cornea of a frog, excised and kept alive by the addition of some aqueous humor of the eye, or serum of the blood, we may look, even with high powers of the microscope, through its whole thickness. At first this appears homogeneous, almost structureless, with faint cloudy shadings. By and by, grayish, branching formations will emerge, known as the protoplasmic bodies of the cornea or "cornea-cells." It has long since been proved that these bodies are alive in the living cornea, amœboid, viz., may change their shapes under the influence of a weak Faradic current. The longer we keep the cornea alive the more of its protoplasmic bodies become conspicuous, all being branching and inter-connected. W. His, as early as 1856, described the cornea corpuscles of a child as branching and interconnecting bodies, of such a breadth and profusion that the intervening basis substance would occupy less space than the cornea corpuscles themselves. He, therefore, was the first accurate observer of the cornea corpuscles, and his description and figures certainly agree with my own drawing of the cat's cornea, with the exception that he used a much lower power of the microscope than I.

Where are the cells? Where are the individuals? The

answer is: there exist *none* throughout the whole cornea of either man or lower animal. The so-called "cells" of the cornea are nothing but continuous protoplasmic tracts with thickenings at the points of intersection, where the nuclei are embedded. Where does one cell end and the other begin? There is no end and no beginning to the protoplasmic tracts, since they are continuous by both broad and narrow offshoots.

I have proved that this very same structure is met with in all tissues of the animal body, nowhere being found as isolated or individual cells. What, some forty years ago, was considered to be a mere variety of cells by Rud. Virchow and termed by him "branching or stellate cells," so beautifully displayed in the mucoid or myxomatous tissues of the umbilical cord, has been shown by myself, in 1873, to hold good for all types of the connective tissues, *i. e.* the myxomatous as well as the fibrous, the cartilaginous and the osseous. Any one convinced of this fact may eventually condense the new views by saying, as really has been said by some histologists: All the tissue cells of the body are interconnected. Still this verbiage will do no justice to the facts, as I will demonstrate presently.

"The cells are the seats of life; the inter-cellular or basis-substance is inert and lifeless." This is another teaching of the cell-theory. Look at the gold-stained cornea of the, cat such as I have depicted, and you will know better. The basis-substance is pervaded by a reticulum the same as is the protoplasm, the only difference being that in the former it is much more delicate than in the latter.

The reticulum I have proved, in 1863, to be the living or contractile matter proper. I have seen it in motion, in alternate contraction and extension in the creeping Amœba, and in a large number of isolated living protoplasmic bodies, such as, for instance, the colorless blood corpuscles and the pus corpuscles. I have observed the same phenomenon in slabs of hyaline cartilage kept alive under the microscope; in the gray substance of the brain of a recently killed rabbit, and in the cornea corpuscles of the frog, under the same conditions. In fact, what we call life, is exhibited by the microscope in the form of movements of the contractile matter. This, during life, is not anywhere, nor for a single moment at absolute rest throughout the whole body. Since the same formation is found in the basis-

substance also, we will have to say: The basis-substance is alive or pervaded by living matter the same as is protoplasm. Thus we can understand that in normal, but especially in the inflamed cornea, the basis-substance changes its appearance almost continually under our very eyes, just as the sky changes by the condensation and dispersion of the clouds. This discovery and comparison were first made by S. Stricker in Vienna, who, since 1880, has been a convert to my own biological views.

The cell doctrine is a mistake and not in accordance with the simplest facts of histology, as displayed by a piece of corneal tissue. In fact, every particle of any tissue of the body serves as a pulley to overthrow the cellular theory held by most histologists for just fifty years, *i. e.* since 1839, when first established by Theodore Schwann.

The beaded threads of a dark violet or nearly black color are, as is generally admitted, the ultimate terminations of the nerves, the so-called axis fibrillæ, into which the axis cylinder profusely splits upon approaching the surface of the body. What is the axis cylinder? What are its radicles, the axis fibrillæ? The answer is: Condensed formations of living matter. The reticulum is here extended in a linear direction, made up of alternate beads and filaments, continuous both in the longitudinal direction and with the reticulum of living matter of the cornea corpuscles, with which the axis fibrillæ inosculate. Not only are the protoplasmic tracts of the cornea freely supplied with nerves, but the basis-substance also, the finest and ultimate nerve filaments blending with the reticulum of living matter therein enclosed.

The central gray substance of the brain and spinal cord, the same as the so-called "ganglion cells," are traversed by and made up of a rich network of living matter. This gives rise to the axis cylinders in exactly the same manner in which the axis fibrillæ terminate in the peripheral cornea corpuscles. Since the cornea is an extremely sensitive tissue, we realize the continuity of nerve action. Contraction of the living matter at the periphery is carried through the nerves by an identical process, viz., contraction in a linear direction, to the central nerve organ and is felt there as pain. Motor impulse, on the contrary, is a contraction of the living matter, starting in the centre, carried to the muscles and resulting in a contraction of the muscle fibres.

There is no difference in the structure of either motor or sensitive nerves. It is the centrifugal or centripetal course of the contraction that results, in the former instance, in motion, in the latter in sensation.

EXPLANATION OF PLATE.

Lamella of the cornea of the cat, stained with chloride of gold. × 1200.

A A. Broad offshoots interconnecting the protoplasmic bodies.

B B. Basis-substance, pierced by a delicate reticulum.

B′. Nerve fibre terminating in the basis-substance.

C C. Large protoplasmic tract, with nuclei at the points of intersection.

D D. Nerve fibres partly terminating in the basis-substance, partly in the net-work of the protoplasmic bodies.

NOTES ON POLLEN.

JOHN M. HOLZINGER,

INSTRUCTOR IN NATURAL HISTORY IN THE MINNESOTA STATE NORMAL SCHOOL.

DURING the past summer I have taken considerable interest in observing the pollen of our native plants, occupying spare time on these small grains till I have now a more or less complete record, with drawings, of the pollen of two hundred and twenty species of flowering plants.

I began by examining them in water, but I soon found that this medium swells many grains so greatly that they burst almost immediately on being immersed. I therefore followed the suggestion contained in Goodale's "Physiological Botany," and tried sulphuric acid as the medium; and whenever time permitted I made measurements and drawings of the grains, when dry or immersed in water, or in sulphuric acid, taking note whenever a pollen acted unkindly in either medium. The following points, which were new to me, would seem to be of general interest, while some of them may aid others who are interested in this line of investigation.

Most pollen grains swell a little in water. Some expand so rapidly that they burst before they can be examined and their form determined. Of the two hundred and twenty examined I

have found twenty one that burst thus readily. A much larger number swell slowly, discharging their contents as the expansion progresses, so that examination is not feasible after two or three minutes of immersion. A few kinds seem unaffected by water.

Most grains can be examined with advantage in undiluted sulphuric acid. Points of structure come out in this medium which cannot be seen on the dry grain, nor on it when immersed in water. The examination was made with uniform promptness after immersion, as it was found that in many cases there was with the lapse of time, a slowly progressive change of form. Generally, pollen grains swell slightly in sulphuric acid. But some show a decided shrinking.

The extine and intine are differentiated by sulphuric acid. The pollen of *Tilia Americana* affords the finest illustration of this. *Saponaria* and *Lychnis* are also good examples.

Certain groups of closely related families have pollen that becomes red or brown in sulphuric acid. Thus one group in the Polypetalæ comprising the Pink, Purslane and Mallow families; another under the Apetalæ comprising the Four-o'clocks and Goosefoots. *Pastinaca* and *Cicuta*, it seems, are isolated cases; so is *Cirsium lanceolatum*. The pollen of *Apocynum* turns light brown; that of *Sagittaria*, blackish. In all other cases, it is implied, there is no appreciable change of color.

Both the Pinks and the Goosefoots have spherical pollen, with from ten to thirty round perforations in the extine; and, as stated, both turn red in sulphuric acid. *Amaranthus* has a similar pollen, but it does not usually thus turn red. Let me here ask whether this similarity of pollen grains does not point to, or suggest, a common ancestry of the Pinks and Goosefoots, now classed so far a part in the natural system of plants.

The Borrages have some of the smallest pollen grains, which are dumb-bell-shaped, and endure well both water and acid, hardly changing size or form in either medium. The grains of the Parsley family are also inclined to be dumb-bell-shaped, but they are much larger, and further differ from the Borrages in that they have from three to six perforations around the constricted part of the grain. Some of the largest pollens are those of *Malva moschata* (148μ), *Œnothera biennis* (129μ), *Iris versicolor* (oval, 70 by 184μ), *Lilium Philadelphicum* (oval, 52 by 89μ), *Erythronium Americanum* (67 by 93μ); *Anacharis* (now *Elodes*)

Canadensis has grains in groups of four, or two, which measure as much as 258μ.

Some of the most interesting grains for study in sulphuric acid are those of *Lychnis Githago*, *Saponaria officinalis*, the Mallows, the Evening Primrose, the Heaths, not forgetting *Tilia* already mentioned. *Helianthemum Canadense* has the grains in groups of four, like the Heaths, but the grouping differs from that of *Anacharis* where the grains are arranged side by side, while the Heaths have the fourth above the three as a foundation. *Lychnis* has the numerous perforations in the extine covered with hemispherical lids, which come off on immersion in sulphuric acid, an interesting sight, and exceptional.

In closing I would put the following questions, to be answered by future observation: First, in case that ten per cent. of the pollen grains burst readily in water, how far would a wet season, or a rain at the time of pollination, prevent, or would it in any measure prevent, the formation of the pollen tube, and thus make fertilization impossible? Secondly, what is the difference in the chemical composition of the extine, if any, which causes the change of color that takes place when certain grains are immersed in sulphuric acid?

A single drop of blood contains about two and one-half millions of red corpuscles.

An organic being is a microcosm, a little universe formed of a host of self-propagating organisms inconceivably minute and as numerous as the stars in heaven.—*Darwin.*

Parasites are not usually reproductive in the animal which they inhabit. They respect the hearth which shelters them, and their progeny are not developed by their side. The eggs are expelled with the feces, and sown at a distance for other hosts.—*Van Beneden.*

There is scarcely any well-informed person who, if he has but the will, has not also the power to add something to the general stock of knowledge, if he will only observe regularly and methodically some particular class of facts which may most excite his attention, or which his situation may best enable him to study with effect.—*Sir John Hirschel.*

TABLE FOR THE CONVERSION OF MIKRONS INTO FRACTIONS OF AN ENGLISH INCH, COMPUTED ON THE RELATION OF ONE METRE=39.37015 INCHES.

M. D. EWELL, F. R. M. S.

$1\mu = .00003937015''$

.01 μ=.0000004″	10 μ=.0003937″
.02 = ...8	20 =.0007874
.03 = ... 12	30 =.0011811
.04 = ... 16	40 =. . . 15748
.05 = ... 20	50 =. . . 19685
.06 = ... 24	60 =. . . 23622
.07 = ... 28	70 =. . . 27559
.08 = ... 31	80 =. . . 31496
.09 = ... 35	90 =. . . 35433
0.1 μ=.0000039″	100 μ=.0039370″
.2 = ... 79	200 =.0078740
.3 = ... 118	300 =.0118110
.4 = ... 157	400 =.0157481
.5 = ... 197	500 =.0196851
.6 = ... 236	600 =.0236221
.7 = ... 276	700 =.0275591
.8 = ... 315	800 =.0314961
.9 = ... 354	900 =.0354331
1. μ=.0000394″	1000 μ=.0393702″
2. =.0000787	2000 =.0787403
3. = . . . 1181	3000 =.1181105
4. = . . . 1575	4000 =.1574806
5. = . . . 1969	5000 =.1968508
6. = . . . 2362	6000 =.2362209
7· = . . . 2756	7000 =.2755911
8. = . . . 3150	8000 =.3149612
9. = . . . 3543	9000 =.3543314
	10000 =.3937015

TABLE FOR THE CONVERSION OF FRACTIONS OF AN ENGLISH INCH INTO MIKRONS, COMPUTED ON THE RELATION OF ONE METRE=39.37015 INCHES.

M. D. EWELL, F. R. M. S.

MILLIONTHS.		THOUSANDTHS.		INCHES.	
.000001″=	.025μ	.001″=	25.400μ	1″=	25399.954μ
2	.051	2	50.800	2	50799.908
3	.076	3	76.200	3	76199.862
4	.102	4	101.600	4	101599.816
5	.127	5	127.000	5	126999.770
6	.152	6	152.400	6	152399.724
7	.178	7	177.800	7	177799.678
8	.203	8	203.200	8	203199.632
9	.229	9	228.600	9	228599.586

100-THOUSANDTHS.		HUNDREDTHS.	
.00001″=	.254μ	.01″=	254.000μ
2	.508	2	507.999
3	.762	3	761.999
4	1.016	4	1015.998
5	1.270	5	1269.998
6	1.524	6	1523.997
7	1.778	7	1777.997
8	2.032	8	2031.996
9	2.286	9	2285.996

10-THOUSANDTHS.		TENTHS.	
.0001″=	2.540μ	.1″=	2539.995μ
2	5.080	.2	5079.991
3	7.620	.3	7619.986
4	10.160	.4	10159.982
5	12.700	.5	12699.977
6	15.240	.6	15239.972
7	17.780	.7	17779.968
8	20.320	.8	20319.963
9	22.860	.9	22859.959

NOTES ON THE MICROSCOPE STAND AND SOME OF ITS ACCESSORIES.

AN AMATEUR.

IV.

THE STAGE.

THE form of the stage, whether circular, square, or oblong, matters little, provided it is large enough. A stage barely of sufficient width to receive the slide, or even smaller, as I have actually seen, is not desirable. The microscopist never feels comfortable while manipulating the slide, if he is restricted in the freedom of his movements by a small stage. Neither is the material from which it is formed of great importance, although there is really not much margin for choice or criticism, since the material is either brass or glass, or a combination of both. If the stage is firm, steady, strong and large, it may be of almost any form, or of any material that will supply these essentials.

For advanced work there are advantages in circular stages, since they are capable of a complete rotation so as to change the position of the object in relation to the light, instead of a change in the position of the mirror, since it is often necessary to examine the object under varying conditions and directions of the illumination. A rotating stage is therefore a convenience, since, on first class stands, it may be accurately centred by certain appliances supplied to the instrument by the maker, and the object may then be rotated with the stage, and kept at or near the centre of the field of view. This centring of the stage is important when it is to be rotated under an objective of high power, where the field is small, and the difficulty of retaining a rotating object within it is correspondingly great. A few of the cheaper stands have rotating stages, but in order that this accessory shall be satisfactory, the workmanship must be good, and the stage should be supplied with the means for centring, as after a few rotations, the accuracy is lost and the wabbling begins. If the stage can not be centred at the beginning of this kind of work, it will rotate, but it will also rotate the object out of the field. No stand, however, should be rejected because it has a stage that will not rotate. A circular rotating stage is not a necessity, but is a desirable luxury.

The margin of the circular stage on the best stands is bevelled,

silvered, and graduated in degrees for the measurement of the angles of crystals. This is another luxury, and not a very desirable one, as it is seldom used by any microscopist unless he is pursuing the special study of crystallography. I do not know of any stand costing less than one hundred dollars whose stage has these graduations. The ambitious beginner need not be discontented because he is unable to have this rotating, graduated accessory, for without it he may do excellent work, and make many discoveries so far as he is concerned, whether the scientific world previously knew them or not.

The stage should always be firm and steady under pressure, but the pressure should be applied judiciously. All microscope stages, even those on the best stands by Mr Bulloch, Mr Zentmayer and others, will respond to the pressure of the thumbs, and be sufficiently depressed to carry the object out of the focus of a medium power objective. The stage that responds the least is the best, but perfection in this regard seems beyond our reach. Neither is it absolutely essential. The thumbs never press on the stage, unless they are delirious. No heavy objects are placed there. No sane microscopist would put a cobble stone on his stage. The optician may be trusted to give us the best that the conditions of the problem will allow, and the amateur purchaser need never test the stiffness of the stage by the weight of his arms and shoulders transmitted through his thumbs. If he does, he will deserve to test the weight of the dealer's arms and shoulders transmitted through a club.

The stage should be as thin as is consistent with the proper stiffness and steadiness. This is needed to allow for certain effects of illumination. It sometimes happens that an object must be studied by what is called oblique light, that is, the mirror must be so arranged below and to one side of the object, that the reflected light shall impinge upon it obliquely, and occasionally very great obliquity is needed, which can be obtained only when the stage is thin, since a thick stage and a consequently deep aperture in the centre, would prevent very oblique rays from passing through to the object. Many "Students'" stands are faulty in this respect, the makers seeming to think that since oblique light is only needed in somewhat advanced work, the beginner will not care for it. But I believe in offering the beginner advantages which he may not at first appreci-

ate, but which he will at last live up to. The æsthetic craze of striving to "live up to" a blue china jug has happily passed, but the effect of living up to one's privileges remains, and the effort should be even the beginner's.

On every stage there should be some kind of a movable plate on which the slide shall be placed, the whole moving easily under the impulse of the fingers. Many stands, the majority of so-called Students' stands, have no such plate, spring clips being substituted, the slide to be placed under them and moved about by the fingers. This arrangement answers well provided the clips will themselves remain permanently in position while the slide is manipulated. The fingers are soon educated to perform the most delicate movements, guiding the slide by the gentlest pressure, and speedily learning to keep even a living and a lively microscopic creature in the field; but to do these things the spring clips must not press too heavily on the slide, and they especially must be firmly and immovably fixed in their sockets. As a rule they are fitted so loosely into the holes provided for them on the stage, that scarcely more than a breath is needed to move them. The result is, that during the constant manipulations of the slide, they are gradually urged more and more to one side or the other, until finally they strike the edge of the cover glass, push it out of place and, it may be, ruin the object. The microscopist's eye is engaged at the ocular, and his attention is concentrated on the image, so that he can not pay special heed to the spring clips to see that they are not threatening his cover glass. If the dealer offers a stand with very loose spring clips, reject it until he remedies the defect by fastening them in their sockets. Then manipulations as delicate as any to be made anywhere may be made with the slide under them; but a stand with loose clips is a delusion and a snare.

The best, simplest, and most satisfactory device in the shape of a slide holder, or a movable stage plate, is that adopted by Mr Joseph Zentmayer. It consists of a glass plate, sometimes circular, with a central circular aperture, and held down at the back by a single ivory-poined screw, under which it moves smoothly and with great freedom, the pressure of the screw and the consequent ease of the stage movements being easily regulated. The slide simply rests against a narrow strip or ledge of brass, moving only when the glass plate is moved. There is no

pressure upon it; it is hampered in no way; it may be placed in position or removed in a moment; or, if it needs to be fastened in place when the microscope is turned down horizontally to draw the object with the camera lucida, a light spring may be swung above it. This admirable device the majority of dealers use on their higher grade stands, either in Mr Zentmayer's form or modified to suit the exigencies of the case. There is, however, no better form than Mr Zentmayer's original one. With it investigations may be made in any department, except certain very delicate observations only possible with a mechanical stage. If the beginner's stand has Mr Zentmayer's glass stage plate, he may feel entirely contented.

On some of Mr Zentmayer's stands he uses a narrow strip or bar of glass, held in movable position by spring clips, the slide resting against the upper edge of this, and being moved laterally by the fingers, and vertically by moving the narrow bar, the slide retaining its place by its weight. This is commendable because the clips can never come in contact with the slide, but it is not an enviable addition to any stand. To move the slide laterally after it has been moved vertically, the fingers must be shifted from the glass bar to the slide, and while that is being done, a living creature would be out of the field, probably forever, since microscopic animals are usually like time and tide and the rail-roads, they wait for no man to shift his fingers. This is the least convenient and the least commendable of all of Mr Zentmayer's many valuable contributions to the microscope.

Other opticians make a stage of glass which bears on its upper surface a metal slide holder movable by the fingers, the slide being held in place by spring clips. This is not objectionable, as the clips are not disturbed during the manipulations of the slide, the carrier and all moving together. On Messrs Bausch and Lomb's larger stands, this arrangement has a smooth and pleasant motion; the spring clips may be turned back out of the way, and the distance transversed by the slide carrier is ample.

There are, or have been, many forms of movable stages, but most of them have disappeared. Here, as elsewhere, there has been a survival of the fittest. Occasionally, on the less recent stands, but rarely even there, a lever stage may be seen. This consists of two thin brass plates, a long lever piercing the upper one and entering the lower by means of a ball and socket joint,

the former being moved by the action of the lever. This stage, if well made, could not be unqualifiedly condemned, although it had some glaringly objectionable features.

For special studies special stages are made. Warm stages are used, the warmth being produced by heated air, electricity, hot water or by heated metal plates. Some complicated arrangements are described which are often interesting and amusing, for at times it would seem as if the inventors of these queer devices put down on paper what they think ought to be useful, if somebody could make them successful. They have dial plates attached, and thermometers, and spirit lamps, and electric batteries, and steam cylinders, and boilers with a multiplicity of rubber tubes, all of which, with many others for cooling objects, for subjecting them to the influence of gases, and for other purposes, are doubtless more or less useful in their particular departments, but they need not detain us now, as the beginner will not need them, nor the advanced microscopist, either, I imagine.

One of the most delightful of microscopical luxuries, one which in some cases is an absolute necessity, is a mechanical stage, provided it is of the right kind. The beginner will probably not buy a stand with a mechanical stage, though he might do worse things, but if he should even once perform any serious work with that device, he will, I am sure, never abandon it voluntarily. A mechanical stage is a "thing of beauty" and if well made, the rest of that hackneyed quotation is descriptive of it. But what is it? Only a stage so made that the horizontal and the vertical motions are accomplished by rank and pinion. The description is short, it seems a small matter, but the stage is one of the most important parts of the stand. An inconvenient stage means an inconvenient stand. If properly constructed, a mechanical stage is strong, light, firm, durable, desirable and unrelinquishable. If improperly made it may be strong, firm, thin and light, it will be altogether abominable. Scarcely any part of the stand sees so much active service as the stage, unless it is the fine adjustment, and scarcely any part must approach perfection so closely as the stage unless, again, it is the fine adjustment mechanism. To have that part loose and wabbling, with the image dancing at every turn of the screw, is as bad as having lost motion in the racks and pinions of the mechanical stage, or to have the parts loose and rattling, or to have them

"lift," that is to be raised above the general plane surface whenever the milled heads are turned to bring the mechanism into action. Every movement should be smooth, prompt, noiseless. Every slightest touch of the milled heads should be followed by a movement of the stage plate that shall be visible through the microscope, whatever it may be to the naked eye. To be forced to turn the milled heads through part of a revolution before the pinion engages the teeth of the rack, is something that will undermine the best disposition the microscopist is blessed with; and to feel the pinion crunch against the rack, while the whole jolts and bounces along, and lifts the object out of focus, will complete the ruin. Nothing of that kind is made in the United States, but something very similar is made outside of the United States. A perfect mechanical stage reminds me of that human being who is low voiced, and gentle, and kind, and good; whose touch is tender, who makes you love him in spite of yourself; a rare human being, but precious when found. A perfect mechanical stage is a rarity, but a treasure when discovered.

The position of the two milled heads actuating the horizontal and vertical racks, relegate mechanical stages into two groups, one including those with the milled heads projecting beyond the margin and parallel with the surface, the other comprising those with the milled heads perpendicular to the surface. There is little difference in the desirability of either kind, if the milled heads are separated from each other, as they often are; but when both work on the same axis, as some of them work, then there is a choice. Personally, I dislike the stage with the milled heads projecting beyond the margin; I greatly prefer the other form, where they are on the upper surface, perpendicular to it, and working on the same axis. When they are in this first-mentioned position and separated from each other, as they commonly are in this form of stage, using them is, for me at least, awkward and inconvenient, cramping the hand and failing to supply that rapidity of action so desirable in many investigations, because I am forced to abandon the hold on one screw head to seize the other, thus losing time, and often the object as well. This is only a prejudice, however; the reader may prefer a mechanical stage with the milled heads thus arranged. Some accomplished microscopists do so. This was the opinion of my lamented friend, Dr Allen Y. Moore, of Cleveland, young, brill-

iant, kind——dead. He prefered such a stage, because the milled heads did not then occupy any space on the surface, their absence leaving more room for larger slides. But to carry a slide exceeding the standard size of three inches by one, the whole stage must be modified, or the slide must be manipulated directly by the fingers, when many of the advantages of the mechanical accessory would be lost. A movement of an inch in each direction is ample. Mr Zentmayer's mechanical stage is superb in workmanship, admirable in the addition of graduations and other facilities, but it is objectionable, I think, on account of the laterally projecting milled heads, although they accomplish a horizontal motion of one and one-fourth inches, and a vertical movement of one and one-eighth inches, the stage being five inches in diameter. Those who are pleased with such an arrangement of the working parts, will find this the best stage made in this country, which means the best in the world. It costs forty dollars, and is prepared for the American Centennial stand; either reason probably being sufficient to preclude its attainment by the beginner.

A USEFUL COLLECTING DEVICE.

JOHN WALKER.

WHILE pursuing my investigations among the ciliate and flagellate Infusoria, Diatomaceæ and Rotifera that abound in the ponds and lakes around Minneapolis and vicinity, I came to the conclusion that a collecting bottle less cumbersome than the usual affair would be desirable. The one that I had been using, a modification of the Wright pattern, has some advantages over the original, yet it is open to objections. In the first place, it is too large to be conveniently carried about when one is off for a ramble through the woods in search of those secluded clear-water pools, wherein abound the finer forms of microscopic plants which the student of the Desmidieæ knows so well. Secondly, the strainer, though an improvement over the Wright form, is still rather disappointing, as it must be taken out frequently to be cleaned.

Such being my experience, I decided to use a smaller bottle, and have the strainer (I use bolting silk, 10,000 to the inch), outside instead of inside. I therefore procured a bottle holding about four ounces. A square bottle with a wide mouth is pref-

erable, though a round one will answer. I bored four holes opposite each other, one inch above the bottom, and about three-eighths of an inch in diameter, and enlarged the openings in a direction parallel with the length of the bottle until within an inch of the neck. Over these four oblong apertures I cemented fine bolting silk or other desirable material, with shellac, and when dry the bottle was ready for use. To those not having the tools needed for drilling glass, I would recommend a small tin can or box, such as that in which Coleman's mustard is sold, or the common round pepper-box obtainable from the grocery stores, the lid making a good coarse strainer. In fact this form of collecting implement, either from can or box, will allow of many modifications to suit the taste of the investigator, or the material on hand.

In working with it, as with all other forms, the currents of water passing through the meshes of the strainer will cause the fine debris to collect on the inside, which in this case is easily kept clean with a small brush, a piece of wood or a stalk of grass. The concentrated material will be found at the bottom of the vessel, and can be transferred to another small bottle carried for the purpose.

I have found this form of collecting implement very convenient; so much so, indeed, that my old Wright bottle stands on the shelf neglected. The small one and a few homeopathic vials have supplanted it. And they have the advantage of being portable in the coat pocket.

Until recently, in using either bottle, I always carried a small tin strainer to keep out coarser materials, but since writing the foregoing I have experimented with a tin mustard can, "Coleman's," by cutting two oblong openings in the broadest sides, cementing the bolting silk over the apertures, and perforating the lid with holes about one thirty-second of an inch in diameter. On one of the narrow uncut sides I have soldered a brass ferrule with a thread cut inside, while on the end of my walking cane is also a small brass ferrule with an external thread to fit that on the can. This I find very useful for reaching out from the shore.

For collecting the Entomostraca this is the *ne plus ultra* of implements, and when away from home, with the small can and a few little bottles in my pocket, and with a harmless looking

cane under my arm, I am fully equipped to operate on any pond or swamp that may come in sight. Like the modern bullet my outfit is small, but wonderfully effective. And not the least advantage is that the cost is a mere cipher, a fact to commend itself to all.

If the bolting silk should not retain the finer forms, make a small bag of cambric handkerchief, slip it over the bottom of the can and tie in place with a rubber or other band. The Diatoms, Desmids, *et cetera*, will pass through the silk and be caught by the bag, whence they may be washed.

To use this simple but most effective implement for the collection of surface forms when in a boat, a small curtain-ring may be fastened on each side, with a cord passed through each, up over the lid and so connected with the fishing rod or line.

AN OBSERVATION ON THE COMMON HYDRA.

H. E. VALENTINE.

NOTICING some unusually fine specimens of Hydra (*H. fusca*) attached to the sides of my winter jar, a few days ago, I secured one and placed it on the stage of the microscope. My attention was immediately attracted to two swellings of the ectoderm just below the tentacles. The unbroken line of the body was visible through these elevations, there being apparently no connection between them and the interior.

The next evening I had the same animal under observation, but there was a marked change in the appearance of the protuberances. Both had very materially increased in size, and instead of the smooth convex surface seen before, each was surmounted by a kind of knob in which an active circulation was going on. The enclosed space was crowded with particles similar in appearance to the granules usually seen in the vacuoles of a *Closterium*. This movement was also apparent in the main portion of one of the protuberances, although later it became confined to one margin. Among the particles in one of the knobs were two thread capsules which were being turned and twisted about in a very lively fashion.

The cuticular covering of one of the swellings was finally ruptured, and the contents were scattered over the slide. There was a slight oscillatory movement among some of the freed particles,

but as the mass remained quiet, I attributed this to the slight currents produced in the water by the cilia of *Trichodina pediculus*, several of which found a home on the body of the *Hydra*, one in particular seeming to take special delight in climbing back and forth over the aforesaid excrescences.

Never having previously seen anything of the kind in connection with *Hydra*, I thought it might be interesting to others, although it may be nothing unusual.

If any reader has a plausible explanation of the occurrence I wish he would make it known.

EDITORIAL.

DR HEITZMANN'S theory in regard to the reticulated character of certain biological structures, as exemplified in his interesting paper on "The so-called cells of the cornea," published in the present number of THE MICROSCOPE, has the merit of originality, yet few readers will be inclined to accept it to the exclusion of the cell doctrine which he opposes The latter is no longer a theory; the existence of the cell is so frequently demonstrated, and the belief in its presence in animal and vegetable tissues so firmly fixed, that there is little danger of its over-throw. All of Dr Heitzmann's papers are well written, attractive in manner, and interesting in matter, while their author has the courage of his convictions. He is no coward. He makes the onslaught single-handed, and with the bravery of one who feels that being right he must go ahead. His self-imposed task appears to be a hopeless one, yet all that he writes is worth careful reading.

There is no doubt that under certain conditions and at certain times a net-work is observable in both animal and vegetable protoplasm, but it is not constant. Dr Heitzmann claims that it is a permanent and a characteristic feature of at least all animal protoplasm. Few histologists agree with him. Gibson, however, in his recent "Text-book of Elementary Biology," appears to accept the theory. "In intimate structure," he says, protoplasm "consists of a homogeneous portion or matrix in

which are embedded granules. . . . . .After treatment with certain reagents, or in some cases without such treatment, the protoplasmic matrix is found to be composed of a sponge-like arrangement of threads or fibrillæ interlacing with one another and forming a supporting framework, while the interstices are filled with a more fluid homogeneous substance. Most recent investigators into the minute structure of protoplasm agree in thinking that the homogeneous matrix above alluded to corresponds to the interfibrillar matter, whilst the knots on the net work, as well as the fibrillæ themselves when seen end on, furnish the granular appearance. True granules are, however, also found in the interfibrillar matter itself. In the great majority of cells, generally near the centre, is to be found an oval or rounded, rarely irregular, body termed the nucleus. . .Like the cell itself the nucleus consists of a fibrillar net-work and an interfibrillar substance. . .Usually one or more granules of larger size are to be distinguished in the nucleus to which the name of nucleoli has been given, some of which are probably knots on the intranuclear net-work."

Dr Heitzmann will contribute other papers to THE MICROSCOPE, but the reader should remember that contributors are responsible for their own statements. The Editor will allow the fullest liberty of expression, but he declines to be held responsible for any assertions except his own.

THERE is a word in frequent use among those who are not exactly purists in the employment of the English tongue, and which the purists would classify in the homonymes. One of its meanings is thus defined by Worcester: "Taffy, *n.* A kind of candy made by boiling molasses or treacle till it becomes thick, and then spreading it out in sheets to cool, often with almonds stuck in it."

This is an agreeable thing, as the children who have been known to take it on a stick, soon discover. But Worcester says nothing about the secondary and more modern meaning. Whether the great Century Dictionary will do so or not remains to be seen. However, taffy in either form is pleasant. Flattery is commonly insincere, selfish, designing, transparent and disgusting, but a little unfeigned commendation is acceptable to every one. Every body likes taffy, if it is of the true material;

the almonds, too, have a fine flavor. Plain taffy, even without the stick, is good, and always makes life's burdens lighter, and a little easier on the shoulders. The cynic may smile in his lofty way at the sweet stuff, but give him a judicious taste and he will prove not such a bad fellow. We are all alike in our longing for sweet things. Without them the nerves soon begin to ache and the body to droop. The system seems to demand them, and the mental system has a similar need. It, too, welcomes that kind of taffy that comes not on a stick for a cent, but of good, true, honest, acceptable approval, free of cost, spontaneous, sweeter than sweet, perfumed and beautiful.

An excellent place for experimentation in its use is the saddle of a bicycle, with a small boy running beside the rider. At a word, or even a glance, that small boy will begin to hurl epithets to curdle your blood and make your hair quiver at the roots; but say to him: "You are an excellent runner. You should cultivate those fine muscles of yours;" give him a little taffy, and he humbles himself, he prostrates himself in the dust, he is your adorer and you in his sight are a superior being.

Do not stint the taffy. It will not only make things sweet, but it will make them move easily. It is a good lubricant. Along about Christmas is a favorable time to make it, and to "spread it out in sheets to cool," and to stick the almonds in it. It will then be ready for use during the whole year. We all like it. In a recent letter its writer said in reference to a paper in a late number of THE MICROSCOPE, "It is worth a dozen years' subscriptions." And another: "It is the most sensible article I ever read on the subject." That taffy was so sweet and so full of almonds, that it could not be enjoyed alone; the author and the Editor must share it with the publisher; and we all were the happier for it all the week.

Do not spare the taffy. The world will be brighter, and life less wearisome if it be passed around in abundance. Make the sheets large when you spread them out to cool, and do not stint the almonds.

THE experiment of calling the attention of the boys and girls to the microscope is one that can never do harm, and may do great good. The tendency of the majority seems to be toward obliquity of some kind, and to incline them toward the straight

course needs careful attention and gentle nurture; and the microscope will help if it is managed by an intelligent guide. Those of us who make no great pretensions to goodness, yet are moderately honest and decent, desire to see all the world moderately honest and decent, or more so, and we all can help to accomplish that by a little microscopical missionary work among our young friends. Ask the boy into your particular "den," and show him a fly's foot, or a mosquito's head, or some other common thing through the microscope; come down off your stilts and show the young fellow that you are not entirely vinegar and conceit. He will respond in some way at some time. You may be laying a foundation stone to receive after a while a noble superstructure. You cannot tell. The cheery Christmas tide is here with its atmosphere of goodness and generosity, when every body feels kindly toward every body else, when even old Scrooge thaws out and repents. It is an excellent time to begin the experiment. There could be no better Christmas gift than a microscope, or some microscopical accessory.

THIS magazine aims, by means of its published papers, to be not only suggestive of microscopical work and of objects for investigation, but to be helpful to those engaged in making observations in any department of biology or microscopy. It often happens that questions arise that cannot be answered by reference to the authorities at the worker's command, or such queries are suggested by reading, or in some other way. These matters are often of as great importance to others as to the individual originating them, and if answered, might supply just the link to make some other work more complete. The information would at least add something to some one's general fund of knowledge, which is always an important thing to do. All such questions will be welcomed by the Editor of THE MICROSCOPE, and the desired information will gladly be sought from specialists, prominent teachers and investigators, who stand ready to respond and to give generously of their stores for the benefit of others less fortunately situated. If apparently insolvable biological or microscopical problems arise in the experience of any reader they will, on receipt by the Editor, be wrestled with by the proper authority, and the result published in THE MICROSCOPE, for the profit of all. This arrangement will hold good so long as the present Editor is at the helm.

ACKNOWLEDGMENT. — Thanks are due to Miss M. A. Booth for a slide of *Plumatella* statoblasts, and one of the hair from an Indian bat, *Phyllostoma diadema.* Miss Booth is one of the most accomplished preparers of microscopic materials. Her name on the slide is a guarantee for its neatness and perfection of finish. In the mount of *Plumatella* statoblasts the transparency of the annulus is complete and exquisite. From Dr E. Gray, of Benicia, Cal., we have received the remarkable seeds of *Orthocarpus purpurascens;* from Mr Alfred Pell, a mounted slide of the loricæ of two species of *Anuræa*; from Mr Lewis Woolman a slide of the Atlantic City fossil Diatoms, and several admirable preparations from the Rev. F. B. Carter, of Montclair, N. J.

WE recently had a pleasant call from Mr Lewis Woolman the discoverer of the remarkable deposit of fossil Diatoms at Atlantic City, N. J. During the boring of an Artesian well these wonderful forms were found at a depth varying from four hundred to about seven hundred feet. Mr Woolman deserves great credit for his discovery and for the acumen that lead him to it. He will have his reward, if in no other way, at least in the consciousness of having discovered the most important collection of these magnificent plants since the finding of the famous Santa Monica diatomaceous flotsam.

MR ALFRED PELL, of Highland Falls, N. Y., is compiling a list of the Rotifers which have been identified or discovered in this country. Mr Pell will be glad to receive notes from any who are interested in the subject, with a list of their identifications or discoveries. The record will finally be published in THE MICROSCOPE.

THE editorial waste-basket yearns for anonymous communications, and the paper mill stands ready to devour them by day or by night.

NEW PUBLICATIONS.

A TEXT-BOOK OF ELEMENTARY BIOLOGY.—By R. J. Harvey Gibson, A. M. Illustrated with 192 engravings. New York: Longmans, Green & Co. 16mo., pp. viii., 362.—The trouble with the majority of elementary text-books of science is that they

belie their name and are anything rather than elementary. They usually soar beyond the visual range of their selected group of spectators, and thus terrify and repel at the start. And few attract or even instruct by the use of the proper material for elementary description. Gibson's "Elementary Biology" sins in these ways. To begin the subject matter of elementary biology, as Gibson does, with a study of *Protamœba*, *Protogenes* and *Protomyxa*, is worse than absurd. How many professors of biology have ever seen *Protamœba* or *Protomyxa* or *Protogenes?* To study these creatures demands careful work with high power objectives and the appliances of the advanced microscopist. Yet the beginner is expected to begin his biological career with *Protomyxa* and *Protogenes*, when he probably may know enough about the microscope to use a pocket lens improperly.

This book starts its serious work with these lowly creatures, but what use can the ignorant young student have for it? To offer him the common *Amœba* would be bad enough in all conscience, but to decend among Hæckel's Protista and to expect him to follow, is asking rather too much. The author in time arrives at the *Amœba*, to which he devotes a page and a half, leaping thence to the *Spirogyra* of the fresh water Algæ, then proceeding to the salt water Algæ, Fungi, Mosses, Ferns, and flowering plants, the greater portion of the volume being devoted to vegetable biology. Among the invertebrates he considers *Obelia* of the Hydrozoa, with somewhat extended reference to the fresh water *Hydra*, and the common earth-worm; among the vertebrates he selects *Amphioxus*, the common frog, of which an extended description is given, with a concise account of the general physiology of animals, concluding with a short history of biology.

The book is entirely worthless for its intended purpose, yet it is exceedingly valuable. No good teacher of biology would use it, and no novice in the study could. Yet for those who possess no more than a smattering of biological knowledge it will be one of the most useful reference manuals that he can select, and even the advanced observer will find that it contains much edifying and profitable matter. As a reference book and as a text-book for somewhat advanced students it can be cordially commended, but the beginner in the science will do well to avoid it. It is not elementary in the true and praiseworthy sense of the term.

PLANT ORGANIZATION. A REVIEW OF THE STRUCTURE AND MORPHOLOGY OF PLANTS BY THE WRITTEN METHOD. Simplified and Adopted to the Use of Beginners, either in Classes or as Private Students, in connection with any Text Book of Botany however elementary; being Equally Available for Use with or without the Employment of Botanical Technical Terms. By R. Halstead Ward, A. M., M. D., F. R M. S., Professor of Botany in the Rensselaer Polytechnic Institute. Troy, N. Y.: Henry Stowell. Small 4to.——Dr Ward's book is so arranged that the student, after carefully examining root, stem, leaf, flower and fruit can by a few simple entries under the proper heads, prepare a complete description of the plant, with outline drawings, sectional diagrams of ovary or fruit, and even with microscopical sketches of hairs, glands, epidermis and pollen. The book is intended to help the beginner to help himself, and the pupil who faithfully pursues the course here arranged for him, can hardly fail to obtain a knowledge of plants not to be obtained as easily nor so thoroughly by any other method. It is object teaching of the most commendable kind; the pupil teaches himself, since he is learning to observe, and to record what he sees. An elementary Biology on a similar plan would be worth experimenting with, both by teacher and pupil. But to prepare such a book would be a difficult task for even a master of the science.

PRICED AND ILLUSTRATED CATALOGUE OF MICROSCOPES AND ACCESSORIES. James W. Queen & Co. Seventy-first edition.—The firm and its attractive catalogue are so well known that they need no introduction to the readers of THE MICROSCOPE. The catalogue is illustrated with full-page plates of the excellent Acme stands of which Messrs J. W. Queen & Co. are making a specialty.

CORRESPONDENCE.

EDITOR THE MICROSCOPE:—

"An Amateur" is doing well, and although I do not believe all he says, yet he says a good deal that is acceptable. "Another Amateur," in the October number, asks him a question which I no not think he answers. The question is, "Are not the objec-

tives which are made for short tubes as well adapted to them as the long tube objectives are adapted to the long tubes?" If a short tube objective will not bear the extension to the standard length, will a long tube objective bear any better the enormous extension of a long draw-tube in addition to the standard length? My own tube is short, and vastly more convenient than a longer one, particularly if it is ever to be used in a vertical position. My objectives were made for that particular kind of stand, with the exception of a Bausch & Lomb one-eighth. I am anxious to know if I am working at such a terrible disadvantage.

Yours truly,

BOSTON, MASS. GUIDON.

EDITOR THE MICROSCOPE:—

I regret that I have not yet made my meaning plain. It is just this. An objective corrected for a short tube may be an excellent objective for that tube, but it will not be a good objective if used on a long tube; and an objective corrected for a long tube may be a good one when used on a long tube, but it will not be a good one when used on the standard body lengthened to the full extent of the draw-tube. If "Guidon" is employing objectives on a short tube which were made for short tubes, what more does he want? He is certainly not working to a disadvantage. And since the Bausch & Lomb one-eighth is an adjustable glass, he may be able to make the corrections needed to adapt it to use on the short tube, but I doubt if he gets the best results from that excellent objective. If short bodies are to be used, then select objectives made especially for short tubes; if long tubes are to be employed, then take those objectives which have been made for the long bodied instruments, and even then do not detract from a good image by enormously lengthening the draw-tube.

Yours truly,

AN AMATEUR.

EDITOR THE MICROSCOPE:—

The statement of "Amateur" that to put the fine adjustment upon the nose piece, is to put it in an objectionable place, I do not think is the experience of the majority, for this reason. The fine adjustment placed upon the back of the arm necessitates an arrangement whereby it supports the weight of the whole body, and also the weight of all the mechanism of the coarse adjust-

ment, including the milled heads. This makes great weight for the fine adjustment to carry, and as a consequence it takes the super-excellent skill to which "Amateur" refers to construct such an arrangement in a manner that will give that very sensitive and accurate movement so much desired. If, however, the fine adjustment is placed upon the nose-piece it then sustains only the weight of the objective, and for that reason it is far more steady and delicately responsive to the touch than any adjustment which carries so much as one at the back of the arm is compelled to do. The plan adopted by Tolles in the construction of the fine adjustment upon the nose-piece, was particularly to support the end of the spindle above the screw and the milled head, and with such a construction only ordinarily careful workmanship was required to produce a result the excellence of which would remain after years of wear. The objection urged against the adjustment when placed upon the nose-piece, that in its operation it changes the length of the body and consequently the magnifying power, was not by Tolles, I think, considered to have any importance, inasmuch as in all his best work the nose-piece adjustment was used.

Yours truly,

BOSTON, MASS. F. F. STANLEY.

EDITOR THE MICROSCOPE:—

In answer to his query in the February number, D. will find a valuable paper containing instructions for mounting insects without pressure in the December, 1882, issue of the *American Monthly Microscopical Journal.* A synopsis of the process is as follows: 1. Boil in caustic soda solution (1 to 8). 2. Wash out soda solution with hot water. 3. Pour off water and replace by alcohol. 4. Pour away alcohol and replace by ether. 5. Pour off ether, and (a), add alcohol again, and then water, if to be mounted in glycerine or aqueous media; or (b), replace the ether by turpentine for resinous mounting. Preparation of the object is done in a test-tube. For details, the paper should be read.

BENICIA, CAL. EDWARD GRAY, M. D.

EXCHANGES.

This department is for the benefit of SUBSCRIBERS who have microscopical apparatus, material or books which they wish to exchange, and such wants will be INSERTED FREE OF CHARGE The number of insertions given will depend upon the number of exchanges received each month. Subscribers will please notify us when articles have been exchanged or sold. Dealers are referred to our advertising department.

FOR SALE—Bausch & Lomb Model Microscope (No. 521 of their catalogue) as good as new, having been used but a few times. There are two objectives, a 1 inch and a ¼ inch, one 2 inch eye-piece, camera lucida, etc. Everything in perfect order. Will be sold cheap. Correspondence solicited. Address,

S. G. Robbins, Sivery, Pa.

FOR SALE—Fine collection of 144 choice microscopic objects by Wheeler, Moller Watson, and others, including Webb's celebrated micro-writing, arranged Diatoms, Type-plate of Echinoidea, Podura and other tests, in box with lock and key, $40, all new. Send for list. Also, Tolles' first-class ⅙ water immersion, 180°; cost $70, price $37.50; also, Spencer's latest homo-imm. 1-10, 116°, B. A., $52.50.

Geo. H. Curtis, New Richmond, Clermont Co., Ohio.

WANTED—THE MICROSCOPE, Vols. I to IV inclusive.

W. E. Swigert, Spencer, Owen Co., Ind.

WANTED—A copy of the "Microscopical Bulletin," Vol I, No. 5, August. 1884. for which I will send two interesting slides.

M. S. Wiard, New Britain, Conn.

WANTED—Odd volumes and numbers of microscopical periodicals and books on the microscope. Will give microscopical periodicals in return. Send list of what you have and want.

Prof. L. A. Lee, Brunswick, Me.

TO EXCHANGE.—Zeiss-Abbe condenser complete, 2 in. bull's eye condenser, Excelsior dissecting microscope, Schrauer's Improved Sterling microtome, solid ¼ in. eye piece, all new, for good American sub-stage condenser, machine microtome, Polarizer, or objectives. W. N. Sherman, Kingman, Arizona.

WANTED.—Good pathological material; will cut on shares, or give slides in exchange. E. D. Bondurant, M. D., Tuskaloosa, Ala.

FOR SALE—A B. & L. Section Cutter, glass top, and micrometer screw, in perfect order, good as new, cost $7.50; will sell for $5.

H. F. Wegener, 1305 S. Tenth St , Denver, Col.

FOR SALE—Slides of Bacillus Tuberculosis from sputa. Price $1.00

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FOR SALE—A Fresh copy of Kents' Manual of the Infusoria.

D. S. Kellicott, Columbus, O.

FOR EXCHANGE, OR SALE—A Bausch and Lomb best one-sixth, new; cost $40. Will exchange for good set of opticians' trial lenses D. A Baldwin, Englewood, N. J.

WANTED—Diatoms *in situ*, and Pediculi, the latter either in dilute alcohol or carbolic acid, in exchange for Diatoms, recent and fossil, and miscellaneous objects for mounting. M. A. Booth, Longmeadow, Mass.

WANTED—For cash, good heliostat, also polariscope. C, Drawer G, Ansonia. Conn.

WILL EXCHANGE Vol. II. Paleontology of the Ohio Geological Report for a section cutter. A. F. Barnard,

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FOR SALE—A Bausch and Lomb Harvard stand, A and C eyepieces, 1 inch and one-fifth inch objectives, at a bargain. Box 1, Evanston, Ill.